

# Hillpoint Regional Park Coleman Bluff Path Hunters Point Shipyard Parcel A'

San Francisco, CA

Including:  
Hillpoint Park  
Coleman Bluff Path

## Technical Specifications

ISSUED FOR RE-BID  
November 10, 2014

### Consultants:

Landscape Architects  
**CMG Landscape Architecture**  
500 Third Street, Suite 215  
San Francisco, CA 94107

### Civil & Lighting Engineers

**GHD**  
417 Montgomery Street, Suite 700  
San Francisco, CA 94104

### Structural Engineers

**Structural Design Engineers**  
120 Montgomery Street, Suite 1410  
San Francisco, CA 94104-4303

### Irrigation Designers

**Russ Mitchell & Associates**  
2760 Camino Diablo  
Walnut Creek, CA 94597

### Geotechnical Engineers

**ENGEO Incorporated**  
332 Pine Street, Suite 300  
San Francisco, CA 94104

### Owner:

**HPS Development Company**  
One California Street, Suite 2700  
San Francisco, CA 94111

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## SECTION 02000

### MOBILIZATION AND DEMOBILIZATION

#### PART 1 - GENERAL

##### 1.1 General Requirements

- A. The Division 0 General Conditions shall apply to all work of every Section, or Subsection of these Specifications as if fully repeated in each one.

##### 1.2 Summary of Work

- A. Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site.
- B. Demobilization shall consist of all work required to prepare personnel, plant, equipment, facilities, supplies and incidentals for return trip, and removing the same from the job site at the completion of the contract work, including cleaning up any land based staging and storage areas used in the prosecution of the work.

#### PART 2 - MATERIALS

##### 2.1 Material Storage

- A. The Contractor shall designate locations for staging and storage of all materials and equipment and obtain approval from the Owner.

#### PART 3 - EXECUTION

##### 3.1 Equipment

- A. The Contractor's equipment to be used in performing this work shall be of sufficient size and efficiency to meet all job requirements and will be subject to approval by the Owner's Representative.

END OF SECTION

## SECTION 02050

### DEMOLITION AND DECONSTRUCTION

#### PART I - GENERAL

##### 1.1 PURPOSE

- A. The purpose of this work is to develop new parks within the Hunters Point Shipyard. Lennar Urban is the site developer who is redeveloping the subject site to include a mixed-use residential and commercial community with surrounding parks.

##### 1.2 SCOPE OF WORK

- A. Redevelopment of the subject site including but not limited to Demolition and Deconstruction as required for selected parks at Parcel A' Hilltop and Hillside. The Demolition and Deconstruction for this contract shall include removal of existing concrete ditches and miscellaneous concrete. It shall also include removal of existing vegetation, stumps and associated root systems, trash and debris within the limits of grading or corrective grading. All material to be removed shall be recycled or disposed of in accordance with all applicable regulations. This includes offsite removal and dumping fees of all items not acceptable in the compacted fill, as recommended by the geotechnical engineer, and identifying and stockpiling those materials which can be placed in the fill.

The Contractor shall transport, stockpile, and crush all concrete materials from demolition activities in accordance with Section 02059, "Salvage, Recycling, and Reuse". An area behind Building 808 at Hilltop will be designated as the concrete crushing processing yard. No recycled concrete shall be used on site. The remaining portion of the concrete shall be crushed to 3"-minus and must be free of asphaltic concrete. All rebar and miscellaneous debris resulting from the crushing operation shall be off-hauled for disposal. If the stockpile of crushed concrete is inactive for days, the material shall be covered with a tarp to prevent dust migration.

##### 1.3 REFERENCE DOCUMENTS

- A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated November, 2000.
- B. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.
- C. Demolition Deconstruction & Rehabilitation Plan and Physical Inspection

Report, Thomas M. Bylund, P.E.

- D. Hunters Point Shipyard building Inventory-updated (from 1993 Navy Planning Document with SFRA updates).
- E. Site and Parcel Map (updated) prepared by Levine-Fricke/Dames & Moore Group.
- F. Hunters Point Tenant/Re-use Map prepared by Reiner Associates (issue date: December 6, 2000).
- G. Asbestos Abatement Surveys located at Sheppard, Mullin, Richter & Hampton L.L.P. offices.
- H. Geotechnical Exploration report prepared by ENGEO Incorporated, dated October 22, 2004 (Job No. 5638.6.001.01).

#### 1.4 RELATED SECTIONS

- A. Section 01020 Allowances
- B. Section 01025 Measurement and Payment
- C. Section 01040 Coordination
- D. Section 01540 Protection of Property
- E. Section 02170 Environmental Management of Excavated Materials
- F. Section 02200 Earthwork
- G. Section 02225 Excavation, Backfilling and Compacting for Utilities
- H. Section 302 Removing, Plugging and Filling Existing Sewers and Related Structures. Standard Specifications Bureau of Engineering, Department of Public Works, City and County of San Francisco
- I. Article 31 Documents
  - 1. Master Construction Stormwater Pollution Prevention Plan (SWPPP)- See Erosion Control Plan Sheets EI -E6 attached to this section 02050
  - 2. Dust Control Plan
  - 3. Transportation and Disposal Plan
  - 4. Soil Importation Plan
  - 5. Lead-based Paint in Soil Sampling Plan
  - 6. Contingency Plan for the Management of Abrasive Blast Material

## 1.5 QUALITY ASSURANCE

- A. The Contractor shall perform demolition work in accordance with Sections 700 and 701 of the SSDPWSF except as indicated herein.

## 1.6 EXISTING SITE CONDITIONS

- A. Bidders shall visit, inspect, and be familiar with existing site conditions and compare all such conditions with the Plans and Specifications to satisfy themselves as to the accuracy thereof. The submittal of a bid will be considered an acknowledgment by the bidder of familiarity with conditions under which the work is to be performed.
- B. No allowance will be made for any unfavorable conditions or events which might have been foreseen from a thorough examination of the Contract Documents, and the existing site conditions.

## PART 2 -- SITE RECONNAISSANCE

### 2.1 SITE IDENTIFICATION

- A. Parcels A' Hilltop and Hillside consist of about 78+/- dry acres. The site is located in the southeasterly edge of the City and County of San Francisco facing San Francisco Bay between India Basin and South Basin and is accessed from Innes Avenue.

### 2.2 GENERAL DESCRIPTION

- A. Hunters Point Shipyard was formerly occupied by and operated by the U.S. Navy as a ship support and maintenance/repair facility. There are approximately 200 buildings on the site including industrial building, office building, residential buildings, houses and utility buildings, pump stations, sub stations, etc. Approximately 60 buildings are currently being occupied by civilian and public service businesses and activities. There are approximately 3.5 million square feet total of occupied and unoccupied buildings of which approximately 1.7 million square feet are occupied and approximately 1.6 million square feet are currently designated for repair and upgrade for permanent occupancy. There are approximately 93 buildings located on Parcels A and B. Many of these are abandoned housing units and administrative buildings, but at least 15 buildings are currently in some form of use.

## PART 3 -- EXECUTION

### 3.1 GENERAL REQUIREMENTS

- A. Existing facilities shall not be removed or abandoned until their use is no longer required. The Contractor shall notify the Engineer in advance of any intended removal and abandonment of existing facilities.

### 3.2 PREPARATION

- A. Notifications:
  - 1. Underground Service Alert:
    - a) Before commencing any excavation, obtain Underground Service Alert inquiry I.D. number by calling the following phone number:  
Underground Service Alert: 1-800-642-2444
    - b) Allow four (4) calendar days after I.D. number is obtained and before excavation work is started so that utility owners can be notified.
    - c) I.D. numbers will not be given more than 10 calendar days prior to starting excavation work.

### 3.3 PROTECTION

- A. The Contractor shall provide for temporary protection of street lighting and traffic signals required for construction operations.
- B. Preservation of Property: The Contractor shall take necessary precautions to preserve and protect private and public property within and adjacent to the Contract site.
- C. The Contractor shall provide and maintain barricades, guard rails, plates and other safety devices as required as incidental work.

### 3.4 SURVEY REFERENCE POINTS

- A. The Contractor shall locate and preserve horizontal coordinates and vertical elevations of San Francisco survey monument points during construction. The Contractor shall call the CCSF Chief Surveyor at 415-554-5810 to report any monuments in danger of destruction or removal. All city monuments must be protected per State Land Surveyors Act and City and County of San Francisco Standard Specification Section 107.09.



### 3.5 DEMOLITION DESCRIPTION

- A. Demolition shall include complete demolition, loading, removal, hauling, and disposal fees.
- B. Miscellaneous Concrete  
Miscellaneous concrete shall include Concrete Ditches as described in the Contract Documents.
- C. Landscaping  
Site landscaping, which includes trees, brushes, shrubs as well as miscellaneous landscaping as shown on the Contract Documents shall be removed. Trees, bushes and adjoining landscaping shall be protected according to tree protection plan and as per City of San Francisco requirements.

### 3.6 DISPOSAL

- A. Dispose of all removed and demolished materials in a legal manner as Contractor's property, except for items indicated to be salvaged and delivered to the City.

### 3.7 PERMITS

Permits which will be required for the subject work and may be required depending on whether conditions and potential underground hazards. Contractor shall obtain all required permits prior to the work. Contractor shall provide copies of all permits to the engineer and/or the city prior to the work. Contractor shall obtain the following permits and any other permits that are required to undertake the work:

- A. Permit to transport demolition debris off site shall be obtained by the contractor prior to start of work. Permits shall be submitted to the engineer and city.
- B. Bay Area Air Quality Management District Permit
- C. Demolition permit
- D. All other permits required by regulatory agencies

### 3.8 DUST CONTROL

Dust Control requirements are included in the Dust Control Plan.

END OF SECTION

## SECTION 02059

### SALVAGE, RECYCLING AND REUSE

#### PART 1 - GENERAL

##### 1.1 General Requirements

- A. The General Conditions and Special Conditions shall apply to all work of every Division, Section, or Subsection of the Specifications as if fully repeated each one.

##### 1.2 Project Goals

- A. In order to comply with the California Integrated Waste Management Act of 1989 (which requires a reduction of 50% of materials land filled), meet environmental goals during the deconstruction of the Parcel A' buildings and structures, and to be cost-effective, the Contractor shall attempt to maximize reuse and recycling of nonhazardous waste materials generated and minimizes the amount of waste requiring landfill disposal. No recycled materials shall be used onsite.

##### 1.3 Definitions

- A. Recycling/Recyclables: Non-hazardous residential, commercial or industrial material(s) or byproducts which are set aside, handled, packaged, or offered for collection in a manner different than Solid Waste for the purpose of being reused or processed and then returned to the economic main stream in the form of commodities.
- B. Reuse: Reusing materials in the form and manner in which they were previously used.
- C. Salvage: Materials suitable for storage, donation, sale, resale or reuse on current or future projects.
- D. Solid Waste (trash, debris, rubbish and garbage for landfill disposal): All putrescible and non-putrescible solid, semi-solid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, non-recyclable demolition and construction wastes, discarded home and industrial appliances, and treated or chemically fixed sewage sludge which is not hazardous waste.
- E. Recycling and Disposal Facility: Any disposal facility fully permitted by the State of California to accept mixed construction and demolition debris and that recovers, at minimum, clean wood waste, scrap metal, inert aggregate debris, and fines.

## PART 2 - MATERIALS - Not Used

## PART 3 — EXECUTION

### 3.1 Waste Management and Reporting

- A. The Contractor shall submit Form A below to the Owner's Representative at least seven working days prior to the start of deconstruction and demolition activities for each building and structure. The Contractor shall list the type and estimated bulk quantities of each material generated during deconstruction. The Contractor shall also list the anticipated method of handling (i.e, salvage for future use, recycling or landfill disposal) and the proposed destination for the material.
- B. After completion of deconstruction/demolition of each building and structure, the actual quantities and types of materials, method of handling, and final destination, shall be recorded by the Contractor on Form B below and submitted to the Owner's Representative within seven working days of completing work on the building or structure.

### 3.2 Contractor Responsibilities

- A. The Contractor shall be responsible for the following actions:
  - 1. Execution of and compliance with the Remediation and Deconstruction Work Plan (RDWP) and the Project specifications.
  - 2. Designating an individual(s) on the jobsite responsible for instructing workers and overseeing proper waste management practices (offsite recycling, salvaging and reuse) at the jobsite.
  - 3. Conducting regular jobsite meetings and providing instruction of appropriate separation, handling, offsite recycling, salvage, re-use and disposal methods to be used by all Contractor and Subcontractor workers at the appropriate stages of deconstruction and demolition activities.
  - 4. Making arrangements with local haulers and recyclers for containers, collection, transportation and final disposition of all materials generated for offsite recycling and/or disposal. This includes the number and placement of containers, signs for containers designating materials for separate storage and collection for reuse or offsite recycling or disposal, and the frequency and schedule for collections to avoid overflowing containers, odors and blowing litter or debris. This also includes identification of salvage companies, recycling markets and authorized landfills for designated materials.

5. Complying with separation, storage, and collection requirements of the selected haulers and recyclers to keep materials consistent with requirements for acceptance by the designated facilities.
6. The Contractor shall avoid contamination by clearly marking off and labeling a specified area to facilitate the separation and storage of materials for offsite recycling, salvage, reuse and disposal.
7. The Contractor shall avoid odors and blowing debris by keeping the area and containers neat and clean.

The Contractor shall keep a daily log for tracking and recording quantities and disposition of all materials generated during deconstruction and demolition activities. Information will include the quantities of material by type, the method of handling, and the company name and location of the final disposition of all materials and be reported on Form B. Actual weight tickets and/or bills of lading shall be attached to Form B and provided to the Owner's Representative.

### 3.3 Material Recycle and Disposal

- A. The Contractor shall deliver to the concrete crushing processing yard all nonhazardous salvageable, reusable and recyclable concrete. No recycled material shall be used onsite.
- B. The concrete shall be broken into sections no larger than 2 ft x 2 ft x 2 ft.
- C. All rebar protruding from the face of the concrete shall be cut flush with the surface of the concrete prior to delivery to the concrete crushing processing yard.

The Contractor shall be responsible for the proper distribution and disposal of the salvageable, reusable and recyclable materials as well as the proper disposal of all non-hazardous and hazardous waste generated during the Project.

END OF SECTION

## SECTION 02170

### ENVIRONMENTAL MANAGEMENT OF EXCAVATED MATERIALS

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. This Section alerts the Contractor that work in this Contract may involve working in environments that may be hazardous, contaminated, or non-hazardous.
- B. Such hazardous, contaminated, and non-hazardous environments may include, but are not limited to hazardous and non-hazardous materials, soils, groundwater and storm water; heavy metals; petroleum hydrocarbons; polynuclear aromatic hydrocarbons; organic compounds; asbestos; serpentine rock (which may contain natural asbestos); lead based paint materials; railroad ties; sewage; sludge; debris; grit; sewer gases; oxygen deficiency; bacterial/biological contamination; and confined spaces.
- C. Hazardous and non-hazardous waste shall only be disposed at a certified and permitted California landfill, or an equivalent out-of State landfill.
- D. All work in this Section shall be accounted for, in accordance with Article 31 of the General Requirements, except for the bid items for transportation and disposal of waste excavated soils and other materials.
- E. The Contractor is hereby notified that any screening or crushing operations of excavated materials cannot proceed without the appropriate BAAQMD, and CalEPA/DTSC permits.
- F. The Contractor is responsible for adherence to plans submitted to fulfill requirements of the San Francisco Health Code Article 31 (listed in Paragraph 1.2 below and included as attachments to these specifications)

##### 1.2 RELATED SECTIONS AND PLANS

- A. Section 00814 – Health and Safety Criteria
- B. Section 01500 – Construction Facilities and Temporary Controls
- C. Section 02050 – Demolition and Deconstruction

D. Section 02200 – Earthwork

E. Article 31 Documents:

1. Master Construction Stormwater Pollution Prevention Plan (SWPPP)
2. Dust Control Plan
3. Transportation and Disposal Plan
4. Soil Importation Plan
5. Lead-based Paint in Soil Sampling Plan
6. Contingency Plan for the Management of Abrasive Blast Material and Unknown Hazardous Materials

### 1.3 CITED REFERENCES

- A. Geotechnical Exploration, Hunters Point Hilltop Site, San Francisco, California, March 2004, 5638.1.002.02, by Engeo, Inc.
- B. Geotechnical Exploration, Hunters Point Hillside Site, San Francisco, California, March 2004, 5638.1.003.02, by Engeo, Inc.
- C. Landslide Exploration Behind Building No. 813, Hunters Point, Hilltop Site, San Francisco, California, March 2004, 5638.1.004.02, by Engeo, Inc.
- D. Finding of Suitability to Transfer (FOST) for Parcel A, Hunters Point Shipyard, TetraTech, Inc., October 2004
- E. Parcel A Remedial Investigation Report, Hunters Point Annex, San Francisco, PRC, September 1995
- F. Hunters Point Annex Parcel A Record of Decision, PRC, November 1995
- G. Final Environmental Impact Statement for the Disposal and Reuse of HPS, Navy, June 2004
- H. Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939-2003, August 2004, Naval Sea Systems Command, Radiological Affairs Support Office

#### 1.4 SUBMITTALS

- A. Pursuant to the provisions of Section 26 of the General Requirements and Section 01300, Submittals, the Contractor shall submit items listed below:

| Section 02170 Submittal List  |                       |                     |   |
|---|-----------------------|---------------------|---|
| Submittal   | Submittal Time        |                     | Reference   |
|   | Prior to Construction | During Construction |   |
| Personnel training records  | X                     |                     | Abrasive Blast Material (ABM) and Unknown Hazardous Materials |
| Health and safety plan  | X                     |                     | Section 02170, Paragraph 1.8, and Section 00814               |
| Contractor contact information  | X                     |                     | Master Construction SWPPP for Parcel A Phase I Construction   |
| Subcontractor contact information   | X                     |                     |   |
| Project schedule  | X                     |                     |   |
| Site layout, sequence of work and BMPs to be implemented  | X                     |                     |   |
| Known onsite contamination requirements   | X                     |                     |   |
| Description of non-stormwater discharge and associated BMPs   | X                     |                     |   |
| Post-construction BMP requirements  | X                     |                     |   |
| Training records  | X                     |                     |   |
| Site inspection records   |                       | X                   |   |
| Estimate of required volume of imported fill  | X                     |                     | Soil Importation Plan   |
| Initial chemical analysis of imported fill  | X                     |                     |   |
| Chemical analysis of imported fill at frequency of 1/5000cy to first 20,000cy and 1/10,000cy thereafter |                       | X                   |   |

| Section 02170 Submittal List              |                       |                     |  |
|---|-----------------------|---------------------|--|
| Submittal                                 | Submittal Time        |                     | Reference  |
|   | Prior to Construction | During Construction |  |
| UST Removal Report                        |                       | X                   | Section 02170, Paragraph 1.13 Transportation and Disposal Plan |
| Results of waste characterization testing |                       | X                   |  |
| Estimate of waste quantity                | X                     |                     |  |
| Selected landfills for all waste streams  | X                     |                     |  |
| Licenses/certifications for waste haulers | X                     |                     |  |
| Daily logs                                |                       | X                   |  |
| Bills of Lading/Hazardous Manifests       |                       | X                   |  |
| Emergency response procedures             | X                     |                     |  |

- B. The Contractor shall submit items due prior to construction at least ten (10) working days before any soil disturbing activity, and no later than thirty (30) calendar days after the Notice to Proceed.

## 1.5 CLASSIFICATION OF EXCAVATED MATERIALS

- A. Based upon available analytical data, California Class 1, California Class 2 (non-RCRA) and Federal Class 1 (RCRA) hazardous wastes are not anticipated to be encountered during excavation at the project site with the following exceptions:
1. Soil around deconstructed building foundations may contain lead-based paint.
  2. Abrasive blast materials may be encountered during excavation.

## 1.6 GENERAL MANAGEMENT OF EXCAVATED MATERIALS



- A. The public shall not have access to the "work" area. Construction areas should be secured to prevent any access by the public.
- B. The Contractor may use its own or a subcontracted intermediate soil staging and loading facility that is geographically contiguous to the Hunters Point Shipyard Development Project. Such a facility shall be permitted as per Federal, State and local regulations and meet the definitions as per the California Code of Regulations (CCR) Title 22, 66260.10 for "Individual generation site", "Onsite", "Onsite facility", and "Onsite hazardous waste facility", as well as other regulations in 22 CCR.
- C. The Contractor is responsible for the excavation, loading, handling, transportation and disposal of all surplus waste excavated soils (including serpentine) and sediments from dewatering activities, meeting requirements of a certified and permitted California landfill or an equivalent out-of State landfill. All such disposal activities shall require the approval of the Engineer prior to actual loading and disposal. Contractor shall obtain written approval from the Owner's representative for disposal of any waste and the selected disposal facility.
- D. The Contractor is responsible for the selection of a facility acceptable to the Owner's representative. It is the Contractor's responsibility to meet landfill requirements for disposal. Transportation and disposal requirements are further defined in the Transportation and Disposal Plan.
- E. The Contractor shall not conduct any soil or ambient air sampling and analysis without prior permission from the Engineer. This does not exclude the Contractor's from its obligation for personnel air monitoring.
- F. The Contractor shall inform the Owner in writing and obtain Owner's approval prior to any sale, supply, or offer to sell any excavated material. The Contractor shall similarly comply with Bay Area Air Quality Management District (BAAQMD)'s Regulation 11, Rule 14 for asbestos-containing serpentine (Additional information may be found at <http://www.baaqmd.gov/regs/rg1114.pdf>), the California Air Resource Board (CARB) Advisory #161 (<http://www.arb.ca.gov/cd/advs161.htm>), and Title 17, Section 93106 of the California Code of Regulation (CCR). In such a case, the Contractor at its own expense shall perform any and all engineering and chemical testing as required by the City and by federal, state and local statutes, laws, regulations and policies.
- G. Asphalt, concrete, aggregate base, vegetation, debris, wood, obstructions, and other organic, unsound or deleterious matter shall be excavated separately from the soil layer, and shall become the property of the Contractor. The removal, management, transportation and disposal of

asphalt, concrete, aggregate base, vegetation, debris, wood, obstructions, and other organic, unsound or deleterious matter shall be incidental to its respective bid item. Soils of different waste disposal classification shall be excavated, managed and transported separately, with no mixing of the different types of wastes.

- H. For work in this Contract, the Contractor shall take into account the productivity losses, if any, due to but not limited to encountering and managing hazardous or nonhazardous materials, the use of respirators and personal protective equipment. The Owner will not pay any additional compensation to the Contractor due to encountering and managing hazardous or non-hazardous materials, use of respirators, and personal protective equipment.

All costs associated with the temporary stockpiling of soils shall be borne by the Contractor. No additional payment shall be made therefore. Such related costs include, but are not limited to dust control, vacuum and wet sweeping, covering of stockpiles, multiple handling and transportation, multiple staging, work re-sequencing or rescheduling, time loss and standby time due to the duration of storage, and complying with federal, state and local requirements.

## 1.7 DEFINITIONS

- A. Generator: The Owner is the "generator" as defined in Section 66260.10 of Article 2, Chapter 10, Division 4.5 of Title 22 of the California Code of Regulations (CCR) and in Title 40, Code of Federal Regulations (CFR) of any excavated hazardous waste. The Owner will be responsible as the generator to the extent of the law.
- B. Waste: Any discarded material of any form as defined by the Code of Federal Regulations 40 CFR 261.2 (<http://www.access.gpo.gov/nara/cfr>) and the California Code of Regulations 22 CCR 66261.2 (<http://ccr.oal.ca.gov>).
- C. Hazardous Waste: A material determined to be a waste. This may include excavated material, asbestos, loose and peeling lead-based paints and any other material that is regulated by and requires management, handling, transport, treatment, storage and disposal according to the requirements of the Federal Resource Conservation Recovery Act (RCRA) and associated regulation 42 U.S.C. 6901 et seq. (<http://www.access.gpo.gov/congress/cong013.html>) and 40 CFR Part 260 et seq., or the California Hazardous Waste Control Law (<http://crl.losrios.cc.ca.us/~hodappd/20a/callaw/index.htm>) and associated regulations (Health and Safety Code 25000 et seq. (<http://www.leginfo.ca.gov/calaw.html>) and 22 CCR 66260 et seq.).

- D. Management of excavated materials or "management" means transportation, transfer, recycling, recovery, disposal, handling, processing, storage, and treatment of excavated materials as per federal, state and local laws and regulations.
- E. Soil: means earth material composing the superficial geologic strata (material overlying bedrock), consisting of clay, silt, sand, or gravel size particles as classified by the U.S. Soil Conservation Service. Soil does not include asphalt, concrete, aggregate base, vegetation, debris, wood, obstructions, and other organic, unsound or deleterious matter.
- F. Excavated material includes all soil excavated, handled, and managed in the course of the contract work. Excavated material does not include asphalt, concrete, aggregate base, vegetation, debris, wood, obstructions, and other organic, unsound or deleterious matter.
- G. Waste excavated soil is excavated soil that is a waste and cannot be re-used within the project site per the re-use criteria of Sections 02170 and 02200. It is surplus, and is to be managed, transported, and disposed of as part of the contract. Waste excavated soil does not include asphalt, concrete, vegetation, wood, debris, obstructions, and other organic, unsound or deleterious matter.
- H. The following soil classifications with corresponding requirements are established solely for the purpose of payment for the transportation and disposal of the surplus waste excavated materials:
  - 1. Federal Class 1 (RCRA) hazardous waste: is waste excavated material that is classified as Federal (RCRA) hazardous waste, requires treatment and disposal at a Class 1 RCRA treatment/disposal facility or a similarly permitted out-of-state facility and requires transport by a registered hazardous waste transporter.
  - 2. California Class 1 (non-RCRA) hazardous waste: is waste excavated material that is classified as California (non-RCRA) hazardous waste, requires disposal at a Class I disposal facility or a similarly permitted out-of-state facility and requires transport by a registered hazardous waste transporter.
  - 3. California Class 2 waste (Class 2): is non-hazardous waste, and is not a California or Federal hazardous waste. It requires disposal at a California Class 2 disposal facility or at a similarly permitted out-of-state facility without the need of a registered hazardous waste transporter.

## 1.8 WORKERS' HEALTH AND SAFETY

- A. In accordance with Section 00814, Health and Safety Criteria, the Contractor shall prepare and submit an activity-specific health and safety plan to address

worker safety. The health and safety plan shall conform with requirements of Title 29 CFR 1910.120, Title 8 CCR, and other applicable regulations. The Contractor's health and safety plan shall be prepared by a certified industrial hygienist or other qualified professional, and comply with applicable Cal/OSHA rules and regulations in effect at the time the activity is being conducted. The health and safety plan shall include at a minimum:

1. Risk or hazard analysis for each activity to be performed
  2. Training requirements for employees including use of personal protective equipment, work practices to minimize risk, use of engineering controls and equipment, medical surveillance requirements
  3. PPE to be used for each site task
  4. Medical surveillance program
  5. Frequency and types of air monitoring, personnel monitoring, monitoring techniques and maintenance of equipment
  6. Site control measures
  7. Decontamination procedures
  8. Emergency response plan
  9. Spill containment program
  10. Additional measures to address ABM as specified in the Contingency Plan for Management of Abrasive Blast Material and Unknown Hazardous Materials.
- A. The Contractor shall provide sufficient numbers of properly trained personnel who may come in contact with, may be exposed to, disturb, operate equipment or otherwise excavate, handle, transport and dispose hazardous or contaminated excavated material. Training requirements are as defined in the activity-specific health and safety plan to be prepared by the Contractor.
- B. The Owner will not grant extensions of time or increases in payment for costs associated with the Contractor's inability to provide properly trained personnel, costs of training Contractor's workers, hiring of required personnel.

#### 1.9 REGULATORY INDEMNIFICATION

- A. The Contractor shall retain, and the Owner will not indemnify against, any liability of the Contractor resulting from the activities or duties, which are the responsibility of the Contractor under the terms of this Contract. This includes, but is not limited to, liability arising from the arrangement of transportation of any excavated material, whether on- or off-site. Therefore, the Owner will not assume any liability, present or future, incurred by the Contractor by reason of these activities.
- B. The Contractor is specifically alerted to, and shall familiarize itself and its subcontractor(s) to the liability statutes of:

1. The Comprehensive Environmental Responses, Compensation, and Liability Act (CERCLA) of 1980 found in 42 USC, Section 9601 et seq.
2. The Superfund Amendments and Re-authorization Act (SARA) of 1986 found in 42 USC, Section 9601 et seq.
3. The California Hazardous Substance Account Act (HSAA) of 1981 found in California Health and Safety Code, Section 25300 et seq.
4. California Health and Safety Code (H&SC), Division 20, Regulations and CCR 22 Section 6600 et. seq.
5. Cal/OSHA Lead in Construction Standard, Title 8, CCR, Section 1532.1.
6. BAAQMD Regulation 6 for Particulate Matter and Visible Emissions (<http://www.baaqmd.gov/regs/rq0600.pdf>) and Regulation 11 for Hazardous Pollutants (<http://www.baaqmd.gov/regs/rulereg.htm>).

- C. The Contractor shall be responsible for all liability and costs necessary to prevent its own or subcontractors' operations from violating any federal, state, or local statutes, laws, regulations and policies.

#### 1.10 TRANSPORTATION AND DISPOSAL OF EXCAVATED MATERIALS

- A. Transportation and disposal of excavated materials shall be performed in accordance with the Parcel A Transportation and Disposal Plan.

#### 1.11 BILL OF LADING PROCEDURES FOR CLASS 2 MATERIAL OR LESSER

- A. Documentation of Class 2 materials transported offsite shall be performed in accordance with the Parcel A Transportation and Disposal Plan.

#### 1.12 HAZARDOUS WASTE MANIFESTING PROCEDURES FOR CLASS 1 MATERIAL

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to transport those materials identified as hazardous waste for the purpose of disposal.
- B. The Contractor shall comply with all hazardous waste manifesting procedures included in the Parcel A Transportation and Disposal Plan, all applicable regulatory requirements listed as well as other applicable federal, state, or local laws, codes and ordinances, which govern or regulate transportation of wastes (including but not limited to Department of Transportation [DOT], DOT-UM 181 as per 49 CFR 172).

### PART 2 — PRODUCTS (Not Used)

## PART 3 — EXECUTION

### 3.1 MANAGEMENT OF LEAD-BASED PAINT CONTAMINATED SOIL

- A. Soil contaminated with lead-based paint shall be identified and managed as described in the Parcel A Sampling and Analysis Plan for Lead-based Paint.
- B. Temporary stockpiling of lead-contaminated soil shall be performed as described in the Contingency Plan for Management of Abrasive Blast Material and Unknown Hazardous Materials and in accordance with the requirements of the Parcel A Construction Stormwater Pollution Prevention Plan and the Parcel A Dust Control Plan.
- C. Lead-contaminated soil shall be transported and disposed of in accordance with the Parcel A Transportation and Disposal Plan.

### 3.2 MANAGEMENT OF ABRASIVE BLAST MATERIAL

- A. Abrasive Blast Material shall be identified and managed in accordance with the Contingency Plan for Management of Abrasive Blast Material and Unknown Hazardous Materials.

### 3.3 UNFORESEEN ENVIRONMENTAL CONTAMINATION

- A. In the event that suspected environmental contamination is encountered, the Contractor shall immediately suspend the work in the immediate area, secure the area and notify the site safety representative and Engineer.
- B. If the suspected environmental contamination is confirmed, it shall be managed, transported and disposed of in accordance with applicable environmental regulations and in conformance with the procedures outlined in the Contingency Plan for Management of Abrasive Blast Material and Unknown Hazardous Materials, the Parcel A Health and Safety Plan, and the Parcel A Transportation and Disposal Plan.

### 3.2 IMPORT MATERIAL

- A. In advance of hauling in any import material, the Contractor shall provide chemical analytical results as described in the Soil Importation Plan. Analytical costs for any imported fill material incurred by the Contractor shall be Incidental Work to the respective Excavation and Backfill Bid Items.

- B. The Contractor shall furnish the above analytical results at least ten (10) working days prior to bringing in the import material. The acceptance of import fill will be made by the Engineer, in accordance with criteria defined in the Soil Importation Plan.

### 3.4 TEMPORARY STOCKPILING OF EXISTING AND IMPORTED SOIL

- A. Contractor shall prepare and submit activity-specific information as an addendum to the Master Construction Stormwater Protection Plan. Contractor shall provide figures designating work areas, stockpile areas, and appropriate BMPs for erosion and sediment controls and material and waste storage areas. Contractor's addendum shall also include monitoring, inspection, training and documentation requirements.
- B. When rain is forecast within 72-hours, hay bales and/or silt traps must surround the stockpile to minimize sediment runoff.
- C. The Contractor shall keep the stockpile(s) of existing soil dry so as to maximize reuse.
- D. After a stockpile has been removed from a completed surface, the Contractor shall wet sweep and vacuum the area, street, and sidewalk to remove any residual dirt.
- E. Do not mix stockpiles of imported soil with existing soil.
- F. The SFPUC retains the right to suspend the use of temporary stockpiling on-site (within the project limits), in the event of negative public perception, aesthetic concerns, and regulatory concerns. In such an event, the Contractor may be required to remove the stockpile within 24 hours.
- G. Additional requirements for management of stockpiles are contained in the Contingency Plan for Management of Abrasive Blast Material Unknown Hazardous Materials and the Construction Stormwater Pollution Prevention Plan.

END OF SECTION

## SECTION 02200

### EARTHWORK

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This section includes provisions for excavation of all materials, regardless of character and subsurface conditions; removal of unsuitable materials and/or hazardous materials; placement of topsoil for landscaping, preparation of base material for placement of other material thereon; all as shown on the Plans, as specified in these Specifications, and as directed by the Engineer.
- B. This section applies to Demolition work.  
  
Refer to Section 02050 Demolition and Deconstruction for additional excavation, handling, hauling and disposal requirements.
- C. Whenever reference to finished grade is made, it shall be considered that the reference is to the finished surface of the completed facility.
- D. During site mass grading operations, site soil was stockpiled, tested for agricultural suitability and placed as top two feet of fill for landscape areas in the parks. Refer to Hunters Point Shipyard Development Project Parcel A' – "Grading and Retaining Walls" As Built Documents for previous soil reports and placement locations.
- E. For the purposes of the soil work under this contract, consider the top 8" of soil to be "top soil" and the lower 6" to be "subsoil". Amend and cultivate the top 14" of soil in landscape areas for planting. Maximum soil compaction in planting areas to be 85%.

##### 1.2 REFERENCE STANDARDS

- A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated November, 2000.
- B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering, dated April, 2007.
- C. State of California Department of Transportation Standard Specifications (CTSS), most recent version.
- D. Department of Public Works, Order No. 171,442.
- E. Geotechnical Exploration report prepared by ENGEO Incorporated, dated



October 22, 2004 (Job No. 5638.6.001.01).

- F. Risk Management Plan.
- G. California OSHA governing requirements.
- H. California State Labor Code.
- I. California State Health and Safety Code.

### 1.3 RELATED SECTIONS

- A. Section 01060 - Regulatory Requirements
- B. Section 01540 - Protection of Property
- C. Section 02050 - Demolition
- D. Section 02170 - Environmental Management of Excavated Materials

### 1.4 SUBMITTALS

- A. The Contractor shall submit drawings, computations, details and construction procedures in support of the installation of shoring, bracing, and excavation support systems. All drawings and computations shall be signed by a Civil or Structural Engineer registered in the State of California.
- B. The Contractor shall submit to the Engineer analytical data as required herein for all imported, non-Owner supplied fill material to be used in this project.
  - 1. Sampling requirements are as follows: one 4-point composite sample for each 500 cubic yards of imported fill.
  - 2. Analyses required for each sample are: LUFT 5 Metals (Cd, Cr, Ni, Pb, Zn) EPA Method 6010; TPH gas+BTXE EPA Method 5030/8015M/8020; and TPH diesel, motor oil, kerosene EPA Method 8015M.
  - 3. The Contractor shall submit to the Engineer required analytical data prior to delivery of the imported fill to the job site. All analyses, are to be performed by a State Certified Laboratory.

### 1.5 QUALITY ASSURANCE

- A. The Contractor shall comply with applicable provisions of Section 200.01 and Part 7 of the SSDPWSF and Section 19 of the CTSS, except as noted herein.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals for doing all work that may be required to construct and maintain the roadway.

### 2.2 IMPORTED OR LOCAL ENGINEERED FILL

- A. Engineered fill shall consist of soil materials, subject to the approval of the project Geotechnical Engineer, placed and compacted as specified in the Parcel 'A' Geotechnical Exploration report prepared by ENGEO Incorporated, dated October 22, 2004 (Job No. 5638.6.001.01).
- B. Imported fill materials shall meet the requirements of the Guide Contract Specifications included in the Parcel 'A' Geotechnical Exploration report, Appendix E, prepared by ENGEO Incorporated, dated October 22, 2004. Additional requirements for imported fill are contained in the Soil Importation Plan.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to beginning excavation, the Contractor shall notify the Engineer of all potential utilities and/or privately owned facilities that may be affected by the work in accordance with the applicable requirements of these Specifications.
- B. Notifications:
  - 1. Underground Service Alert:
    - a. Before commencing any excavation, obtain Underground Service Alert inquiry I.D. number by calling the following phone number: Underground Service Alert: 1-800-642-2444
    - b. Allow four (4) calendar days after I.D. number is obtained and before excavation work is started so that utility owners can be notified.
    - c. I.D. numbers will not be given more than 10 calendar days prior to starting excavation work.

### 3.2 PROTECTION

- A. Preservation of Property: The Contractor shall take necessary precautions to

preserve and protect private and public property including support of utilities within and adjacent to the Contract site.

- B. Protection of Sewer: The Contractor shall take necessary precautions and conduct operations over any sewer to preserve and protect all sewers at all times. Restrict vibratory equipment operations as required to prevent damage to any sewer structure and appurtenances.
- C. All equipment used for compaction shall be such that overstressing underground utilities is avoided.
- D. Protection of Survey Monuments: The Contractor shall take necessary precautions and conduct operations near survey monuments to preserve and protect all survey monuments at all times. If a survey monument is in danger of being damaged or displaced, contact Chief Surveyor at 415-554-5833. All City monuments must be protected per State Land Surveyors Act and City and County of San Francisco Standard Specification section 107.09.

### 3.3 STREET LIGHTS FOUNDATIONS EXCAVATION AND BACKFILLING

- A. Excavation and Backfilling: The Contractor shall assume responsibility for excavation, which shall be done in such a manner as to prevent damage to existing utilities to remain. Excavation shall not be done except as required for immediate use.
- B. Excavation for circular pole footings may be by hand, power driven rotary bucket or auger type drilling rig.
- C. If the excavation is not self-supporting, the Contractor shall install cylindrical forms of sufficiently heavy material to be rigid (i.e. sono-tube or steel) which form shall be left in place. The type of form to be used shall be submitted to the Engineer for approval.
- D. The area around the outside of the forms shall be filled with a concrete slurry mix, 1500 psi, 'A'-inch maximum aggregate, 6-inch minimum slump before the concrete foundation is placed. Backfill material shall be sand.
- E. Prospect Holes for Pole Foundations: If, while excavating for a pole foundation, obstructions are encountered which prevent the placing of the pole in the location shown on the plans or where directed by the Engineer, the Contractor shall backfill the excavation and restore pre-existing improvements not replaced by new work unless otherwise directed by the Engineer. Such work shall be considered as a prospect hole for pole foundation.

### 3.4 MINOR EXCAVATION

- A. Abandoned underground boxes, vaults, pipes, conduits and other enclosures that occupy the work site within planned excavation limits, except for facilities to be salvaged or otherwise designated on the Plans, shall be demolished and removed from the site as Contractor's property as incidental work in accordance with the applicable requirements of Section 108.05, 108.10 and 700.09 of SSDPWSF.
- B. All other excavation not covered by this Section of these Specifications shall be considered minor excavation.
- C. Minor excavation shall include but not be limited to excavation for construction or installation of the following:
  - 1. Sidewalk, curb, gutter, storm water inlets, catch basins, parking meter poles, light poles, traffic signals, traffic signs, street signs, manholes, water meters, irrigation lines, and electrical pull boxes and duct banks.

### 3.5 EXCAVATION SUPPORT REQUIREMENTS

- A. Refer to Section 01060, "Regulatory Requirements" of these Specifications.
- B. The Contractor is responsible for any damage to adjacent structures resulting from construction of temporary support systems, dewatering, and unshored excavations.
- C. Dewatering of trenches and excavations shall be considered incidental work to related excavation work bid item and no separate payment shall be made therefor.
- D. All work required to meet excavation support requirements shall be done as incidental work to the applicable bid items required to perform the work and no separate payment will be made unless otherwise specified.

### 3.6 ENGINEERED FILL PLACEMENT

- A. Engineered fill materials should be placed in accordance with recommendations and Guide Contract Specifications contained in the Parcel 'A' Geotechnical Exploration report prepared by ENGEO Incorporated dated October 22,-2004.

### 3.7 COMPACTION

- A. Compaction shall comply with Section 19-5 "Compaction" of the CTSS and in accordance with recommendations and Guide Contract Specifications contained in the Parcel 'A' Geotechnical Exploration report prepared by ENGEO Incorporated dated October 22, 2004.

### 3.8 SPECIAL TRENCH BACKFILL REQUIREMENTS

- A. Backfilling shall not begin until after the Engineer has inspected and confirmed that the structure or installation is in place and complete.
- B. Additional fill required to replace hazardous material excavated during trenching operations shall be-considered incidental to the respective bid item for which the trenching was required.

### 3.9 RESTORING PAVEMENT AND RELATED IMPROVEMENTS

- A. Temporary paving over trench work may be required to restore pavement for safe and adequate passage for vehicular and pedestrian traffic as specified in the General Conditions. Temporary paving shall be performed as incidental work.

### 3.10 HAULING AND DISPOSAL OF HAZARDOUS MATERIALS RESULTING FROM EXCAVATION

- A. Hauling and disposal of all hazardous material resulting from excavation shall be included in the payment made under the appropriate Contaminated Soil Bid Item and no separate payment shall be made therefor. Refer to Section 02170, "Environmental Management of Excavated Materials."

END OF SECTION

## SECTION 02225

### EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES

#### PART 1 - GENERAL

##### 1.0 REFERENCE STANDARDS

- A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated November, 2000. Also referred to as "Standard Specifications."
- B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated April, 2007. Also referred to as "City Standard Plans."
- C. Department of Public Works (DPW) Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco", approved January 1, 1999.
- D. Geotechnical Exploration report prepared by ENGEO Incorporated, dated October 22, 2004 (Job No. 5638.6.001.01).
- E. City and County of San Francisco, Document 00822 – Statutory and Other Requirements.

##### 1.1 WORK INCLUDED

- A. Section includes (but is not necessarily limited to):
  - 1. Work to the lines and grades indicated on the Drawings and as described herein.
  - 2. Construct, support and maintain all traffic routing and public safety requirement.
  - 3. Construct, support and protect adjoining property and structures.
  - 4. Support and work around existing utilities.
  - 5. Handle all drainage or ground water.
  - 6. Trench excavation and backfill for utility lines.
  - 7. Testing.
  - 8. Clean the site of the work together with all other work necessary or incidental thereto.
- B. Proper means of safety are to be practiced during these operations including, but not limited to, worker safety and dust control.
- C. Upon completion and acceptance by the Owner's Agent of appropriate earthwork, utility construction may proceed.

## 1.2 RELATED SECTIONS

1. Section 02050, "Demolition"
2. Section 02200, "Earthwork"
3. Section 02660, "Low-Pressure Water System"
4. Section 02670, "Reclaimed Water System"
5. Section 02730, "Sanitary Sewer System"
6. Section 02720, "Private Storm Drainage System"
7. Section 16050, "Electrical Materials and Methods"

## 1.3 SHEETING, SHORING, AND BRACING

- A. For all excavation greater than five (5) feet in depth. Contractor shall design, maintain and install sheeting, shoring and/or bracing. Sheeting, shoring and/or bracing to be designed and installed per regulatory requirements of Cal/OSHA, California State Labor Code and UBC. Design shall take into account Project soils, seismic requirements and other constraints. Design shall be designed and stamped by registered civil engineer.

## 1.4 QUALITY ASSURANCE

- A. Contractor shall verify shrinkage characteristics of all soils to be used on the site as, engineered fill. The Owner will not be responsible for additional costs associated with variations in shrinkage or bulking factors and related earthwork quantities.
- B. All testing required by this Section and other Sections of these Specifications shall be performed by an independent, qualified Testing Company as approved by Owner. Retesting required as a result of failed tests shall be at the Contractor's expense.
- C. Codes and Standards: Perform earthwork complying with requirements of Geotechnical Report and authorities having jurisdiction.
- D. Testing and Inspection Service: The owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
- E. Contractor shall employ surveyor to confirm dimensions, locations, and elevations.

## 1.5 TOLERANCES

- A. Earthwork shall be constructed within a vertical tolerance of  $\pm 0.1$  foot, unless

otherwise shown. Grading shall be executed to maintain slopes and drainage.

#### 1.6 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. If Contractor encounters live utilities not indicated, protect the same from damage and immediately notify the Owner's Agent and the affected utility provider. Do not proceed until further instructions are received from the Owner's Agent.

#### 1.7 EQUIPMENT

- A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

#### 1.8 LAND MONUMENTS

- A. Contractor shall notify the Owner's Agent of any existing federal, state, county, and private land monuments encountered. Owner will make arrangements to have monuments "tied-out" and replaced and/or relocated. Monuments destroyed by Contractor, which were not previously shown to the Owner's Agent, shall be replaced at the Contractors expense.

#### 1.9 HAZARDOUS MATERIALS

- A. See Section 02050, "Demolition" for requirements associated with encountering any surface or subsurface materials that Contractor believes are hazardous or potentially hazardous (as defined in Section 25117 of the Health and Safety Code).

#### 1.10 PROJECT CONDITIONS

- A. The Contractor shall visit the site to determine if the existing conditions, nature of materials to be encountered, and all other facts concerning or affecting the work.
- B. Existing Utilities; do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.
  - 1. Provide a minimum 72-hours notice to the Owner and receive written notice to proceed before interrupting any utility.
- C. Any water and debris, which would interfere with construction, shall be removed



from excavated areas. During rainy weather, maintain excavations free of water by pumping and other appropriate means. All water resulting from dewatering operations shall be disposed of in accordance with the requirements of the City and County of San Francisco and/or the San Francisco Bay Regional Water Quality Control Board.

- D. Throughout the entire construction period, keep dust down within the working area along roads used in the operations and all involved portions of site by intermittent watering and sprinkling. In accordance with Bay Area Air Quality Management District (BAAQMD) guidelines, unpaved access roads should be watered three times daily and other active construction areas twice daily. If necessary, all areas should be watered more frequently to prevent visible dust plumes from migrating outside of the development parcel.
- E. Contractor shall keep his work area clean, and in a safe and workmanlike condition so that rubbish, waste and debris do not interfere with the work of other trades.

## PART 2 - PRODUCTS

### 2.1 COMPACTION EQUIPMENT

- A. Compaction equipment shall be of suitable type, adequate to obtain satisfactory breakdown of materials and specified densities to form a dense fill.
- B. Compaction equipment shall be operated in accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained to deliver manufacturer's rated comparative effort. If inadequate densities are obtained, larger and/or different types of additional equipment capable of achieving specified densities shall be used.

### 2.2 MOISTURE CONTROL EQUIPMENT

- A. Equipment for applying water shall be of a type and quality which is adequate for the work, does not leak, and is equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying materials shall consist of blades, discs or other equipment.

### 2.3 BURIED WARNING AND IDENTIFICATION TAPE

- A. Buried warning and identification tape shall be metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 6 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously

over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

|         |                                    |
|---------|------------------------------------|
| Red:    | Electric                           |
| Yellow: | Gas, Oil, Dangerous Materials      |
| Orange: | Telephone and Other Communications |
| Blue:   | Water Systems                      |
| Green:  | Sewer Systems                      |
| Purple: | Reclaimed Water                    |
| White:  | Steam Systems                      |
| Gray:   | Compressed Air                     |

B. Detectable Warning Tape for Non-Metallic Piping

1. Detectable warning tape shall be polyethylene plastic tape conforming to the width, color and printing requirements specified above, but additionally containing integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Minimum thickness of tape shall be 0.10 mm. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Encase metallic element of the tape in a protective jacket or provide other means of corrosion protection.

2.4 SUITABLE BACKFILL MATERIAL

- A. Backfill materials shall be Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, GC, SW, SP, SC and SM; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- B. Bedding and Cover Rock: Bedding and cover rock for storm drain and sanitary sewer that are located below the ground water level shall be bedded and cover with 3/4-inch maximum well-graded soil or rock with no more than 5% passing the No. 4 Sieve. Bedding and cover rock for joint trench shall be 1/2-inch minus material of appropriate gradation to flow around conduit and facilities and fill all voids to ensure adequate support of facilities.
- C. Stabilization. Material: Shall be uniformly graded fractured rock, 3/4 inch maximum by 3/8-inch minimum with no more than 2% passing the # 200 sieve.
- D. Stabilization Reinforcement Fabric: Stabilization reinforcement for storm drain

and sanitary sewer shall be provided utilizing engineered fabrics. These fabrics are to be Geogrid, as manufactured by Tensor (type BX4200), or approved equal. Fabric wrap and lining shall be Mirafi 600X or approved equal.

- E. Clay Trench Seal: Clay Trench Seals shall be constructed of imported impermeable clay. Clay shall have a moisture content that does not exceed optimum moisture by more than 5%.

## PART 3-EXECUTION

### 3.1 GENERAL

- A. Trench excavation and backfill shall be performed in accordance with Part 7, City Standard Specifications, DPW Order No. 171,442, and DPW Order No. 172,236, except as otherwise specified herein.
- B. Surplus Material: Surplus excavated material, if any, shall be disposed of on site as approved by the Owner's Agent or at a suitable location as designated by the Owner's Agent, at the Contractor's expense.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- D. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.2 DEWATERING

- A. Prevent surface water from entering excavations.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

### 3.3 PAVEMENT EXCAVATION

- A. The removal of pavement, sidewalk, parking strip and other roadway structures shall be performed in accordance with Section 701 "Pavement Excavation" of the City Standard Specifications, and in accordance with DPW Order No. 171,442 and DPW Order No. 172,236, unless otherwise specified herein. Sawcuts in concrete pavement and parking strip shall be of sufficient size to provide neat, regular and vertical edges, but shall not be less than 3/4-inch in depth.

### 3.4 TRENCH EXCAVATION

- A. All Trench Excavation shall be performed in accordance with Section 702 "Trench Excavation" of the City Standard Specifications, DPW Order No. 171,442, and DPW Order No. 172,236, unless otherwise specified herein. In addition, according to the Geotechnical Report by ENGEO Incorporated, dated October 22, 2004 (Job No. 5638.6.001.01).

The depth of the trench cited shall be from a point below the finished grade. The section of trench above the finished grade shall be included in the cost of the excavation per linear foot of trench and no additional payment will be allowed for that section of trench cut from the present ground surface to the finished grade. Where the existing elevation is below the finished grade, the depth of the trench shall be measured from the existing pavement grade.

The trench shall be excavated so that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operation connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

- B. The trench shall be excavated in a manner to avoid existing structures, property, and other obstructions encountered during the progress of the work. Utility trenches constructed parallel to foundations should be located entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. The Contractor shall support, protect, maintain, and provide for the safe operation and use of all such structures and property so encountered. Should the Contractor damage any structure or property during the progress of the work, he shall immediately notify the proper owners or authorities and shall arrange for the immediate repair of the same at his expense.
- C. Where excavations extend into Bay Mud, a geotextile shall be placed, overlain by at least 12 inches of crushed rock, unless greater measures are specified in the plans.
- D. Explosives: Do not use explosives.
- E. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.
- F. Comply with the geotechnical report, CAL-OSHA, local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.
- G. Excavations shall be supported and braced to prevent movement of the adjacent soil. Shoring and bracing systems shall be designed by a Civil Engineer registered in the State of California. Drawings and Calculations for shoring shall be submitted for review by the Owner's Agent.

### 3.5 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by 'extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill shall be used to bring elevations to proper position when acceptable to the Architect and Geotechnical Engineer.

Fill unauthorized excavations under other construction as directed by the Architect and Geotechnical Engineer.

### 3.6 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of existing trees.
  2. For soil stockpiles in place for less than 30 days, cover, enclose, water twice daily, or apply non-toxic soil binders (RMP Section 4.3.1).
  3. For soil stockpiles in place for more than 30 days, cover with anchored plastic sheeting or hydroseed (RMP Section 4.3.5.2.1).
  4. For soil stockpiles in place for one year or greater, the stockpiles must be hydroseeded or similarly covered (RMP Section 4.3.5.2.2).
  5. During the rainy season, all stockpiles must be covered with anchored plastic sheeting, hydroseeding, or another equivalent cover (RMP Section 4.3.5.2.1).

### 3.7 TRENCH BACKFILLING

- A. Backfill excavations promptly, but not before completing the following:
1. Acceptance of construction below finish grade.
  2. Concrete formwork removal.
  3. Removal of trash and debris from excavation.

4. Removal of temporary shoring and bracing, and sheeting.
- B. Place backfill materials in layers not more than 8 inches in loose lifts.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages relative compaction according to ASTM D 1557:
  1. Under pile-supported structures, compact to 90 percent relative compaction.
  2. Under on-site sidewalks, steps, and pavements, compact the top-24 inches below subgrade and each layer of backfill or fill material to 90 percent relative compaction.
  3. Under non-pile-supported structures and slabs-on-grade, compact the top 12 inches below subgrade and each layer of backfill or fill material to 95 percent relative compaction.
  4. Under city streets, compact the upper three feet of fill to 95 percent relative compaction.
  5. Under city sidewalks, compact fill to 90 percent relative compaction.
  6. Below the specified depths (items 1 through 4 above) backfill or fill material at least 90 percent relative compaction.
- D. Jetting shall not be permitted.
- E. Where ordered by the Owner's Agent, crushed rock shall be placed in the trench bottom (see Section 703.05, City Standard Specifications).
- F. Warning and identification tape shall be placed parallel to the centerline of the pipe in the trench backfill at an elevation of 18 inches above the top of the pipe, unless otherwise indicated.

### 3.8 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements. Both the subbase and base materials shall be placed and compacted to a minimum 95 percent relative compaction as defined by ASTM DI 557.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency Services: The Owner's Agent will test each subgrade and each

fill or backfill layer. Contractor shall not proceed until test results for previously completed work verify compliance with requirements.

- B. Whenever acceptance of the Owner's Agent is required by these Specifications, the Contractor shall notify the Owner's Agent at least 48 hours prior to commencing any phase of earthwork.
  - 1. No phase of the work shall proceed until the prior phase of work has been accepted by the Owner's Agent.
  - 2. Work shall not be covered up or continued until acceptance of the Owner's Agent has been obtained.
  - 3. The Owner's Agent will give written notice of conformance with the Specifications upon completion of grading.
- C. The Owner's Agent has been retained to observe performance of work under this section.
  - 1. If in the opinion of the Owner's Agent, the work performed does not meet the technical or design requirements stipulated, the Contractor shall make the necessary readjustments as required by the Owner's Agent.
  - 2. No deviations from the contract documents shall be made without specific and written acceptance of the Owner's Agent.
  - 3. In the event of conflict between the Specifications and the recommendations contained in the Geotechnical Report, the Owner's Agent shall be notified.
    - a. The Contractor shall follow clarification and interpretation memoranda prepared by the Owner's Agent at no additional cost to the Owner.
    - b. If clarification or interpretation memoranda should result in a change in the scope of work, an adjustment in the contract price will be mutually agreed upon by the Contractor and the Owner.
- D. The Owner's Agent review of the Contractor's performance does not include review of the Contractor's safety measures.

### 3.10 PROTECTION

- A. Protecting Excavated Areas: Protect newly excavated areas from traffic, and erosion. Keep free of trash and debris.

- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace material to depth directed by the Owner's Agent, reshape and recompact optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

### 3.11 SAFETY PRECAUTIONS

Contractor shall maintain substantial precautions and other protective measures to safeguard workmen and the general public from bodily injury. As part of standard safety precautions, contractor must comply with the provisions of the Risk Management Plan, including preparation of an Environmental Health and Safety Plan.

END OF SECTION



## SECTION 02230

### TREE PROTECTION AND TRIMMING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section includes the protection and trimming of existing trees that are to be preserved, that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
- B. Related Sections include the following:
  - 1. "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
  - 2. "Irrigation" for irrigation trenching.
  - 3. "Planting" for tree and shrub planting, tree support systems, and soil materials.

##### 1.3 DEFINITIONS

- A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated and as indicated on the Drawings.

##### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
- C. Qualification Data: For tree service firm and arborist.
- D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

## 1.5 QUALITY ASSURANCE

- A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of tree protection and trimming.
- B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.
- C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
- D. Pruning shall be performed by a certified arborist who is also a licensed contractor. Pruning shall consist of crown cleaning, crown thinning, and appropriate clearance pruning of all trees to be preserved. All pruning shall conform to the ANZI A300-1995 (sect. 4-5) and ANZI Z133-1994 pruning standards
- E. Any cabling should be performed by a certified arborist.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
  - 1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non soil materials.
- C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch diameter wire; a minimum of 48 inches high; with 1.9-inch diameter line posts; 2-3/8-inch diameter terminal and corner posts; 1-5/8-inch diameter top rail; and 0.177-inch diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete temporary fence system.
- E. Organic Mulch: Wood and bark chips, free of deleterious materials.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
  - 1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Mulch areas inside tree protection zones and within drip line of trees to remain.
  - 1. Apply 2-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.
- D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- E. Maintain tree protection zones free of weeds and trash.
- F. Do not allow fires within tree protection zones.
- G. Any brush clearance around the tree drip line shall be done with hand operated equipment
- H. Each tree to be preserved shall be fertilized.
- I. Once initial health care measures have been administered, 6" of chips will be placed within the drip lines of trees inside tree protection zone. Trees to remain shall be watered at the rate 10 gallons of non recycled water per diameter inch of trunk, twice per month or until an appropriate irrigation system has been installed. Watering shall begin 6 weeks prior to the commencement of any other construction activities.
- J. After the mulching of trees has been completed 6 ft. high chain link fencing will be attached to 2" wide and 8 ft. high posts driven 2 ft. into the ground on 10 ft. centers. Only once fencing has been installed can other construction activities commence.

### 3.2 CONSTRUCTION

- A. Consulting Arborist is required to be on site to supervise any activities within the TPZ and ensure they are completed per contract requirements.
  - 1. Trenching
  - 2. Root cutting and/or removal

3. Remedial tree care activities such as additional pruning, fertilization, and disease/pest control.
- B. The following guidelines shall be always being observed:
1. No un-authorized entry into the TPZ.
  2. All work within the Tree Protection Zone shall be hand labor.
  3. All irrigation or other underground activities should be routed outside the TPZ. Any trenching or root cutting activities within the TPZ must be approved and supervised by a certified Arborist and performed with an air spade and hand saw only. Arborist may recommend further tree preservation measure for the affected trees.
  4. Any roots left uncovered should be kept wet and covered to prevent desiccation until such time that they can be re-buried.

### 3.3 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If roots over 1-1/2 inches are encountered in excavations or immediately adjacent to location of new construction and redirection is not practical, notify landscape architect.
  2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

### 3.4 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, Maintain existing grades to within 2 inches inside tree protection zones.

- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  - 1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
  - 2. Place filter fabric with edges overlapping 6 inches minimum.
  - 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

### 3.5 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Clearance prune any trees to be removed if canopies are shared with a tree to remain. Any trees to be removed that are in felling distance of a tree to be preserved must be removed by a certified arborist.
- C. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- D. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
  - 1. Type of Pruning: Cleaning, Thinning.
  - 2. Specialty Pruning: Restoration
- E. Cut branches with sharp pruning instruments; do not break or chop.
- F. Chip removed tree branches and dispose of off-site.

### 3.6 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- B. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.7 DISPOSAL OF WASTE MATERIALS

- A. Burning is not permitted.
- B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

END OF SECTION 02230

## SECTION 02231

### AGGREGATE BASE

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This Section includes specifications for materials and work necessary for constructing aggregate base under pathways at the locations and to the dimensions shown on the Plans and in accordance with these Special Provisions.

##### 1.2 REFERENCE STANDARDS

- A. State of California Department of Transportation Standard Specifications (CTSS), most recent version.
- B. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated November, 2000.
- C. Standard Plans:  
  
Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering, dated April, 2007.

##### 1.3 SUBMITTALS

- A. Submittals: In accordance with Section 205.03, Samples and Testing, of SSDPWSF.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Aggregate Base: All aggregate shall be in accordance with the requirements of Section 26-1.02A of CTSS, Class 2 Aggregate Base. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.
- B. Permeable Aggregate Base: All permeable aggregate base shall be in accordance with the requirements of Section 68-2.02F of CTSS for Class 2.

## PART 3 - EXECUTION

### 3.1 SURFACE PREPARATION

- A. Subgrade: In accordance with the requirements of Section 26-1.03 of CTSS:
  - 1. Preparation of subgrade to proper grade, including excavating, backfilling and compacting shall be considered as Incidental Work to the applicable bid items where excavation is required to perform the work.

### 3.2 INSTALLATION

- A. Adding Water: In accordance with the requirements of Section 26-1.035 of CTSS.
- B. Spreading: In accordance with the requirements of Section 26-1.04 of CTSS.
- C. Compacting: In accordance with the requirements of Section 26-1.05 of CTSS.
  - 1. All water used for watering shall be applied as Incidental Work.

END OF SECTION



## SECTION 02310

### FINISH GRADING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A Work Included: Execute finish grades complete, as shown, and as specified.

B Work Specified Elsewhere:

1. Earthwork: Section 02200
2. Soil Preparation: Section 02910
3. Irrigation: Section 02810
4. Lawns and Grasses: Section 02920
5. Planting: Section 02930

##### 1.02 PROJECT/SITE CONDITIONS

A Dust Nuisance: Assume full responsibility for alleviation or prevention of dust as a result of grading work.

##### 1.03 SEQUENCING AND SCHEDULING:

A Complete all finish grading prior to installation of irrigation systems.

B Regrade as required to finish grades established by Owner's Representative once the irrigation system is installed.

#### PART 2 - PRODUCTS

2.01 EQUIPMENT: At Contractor's option.

#### PART 3 - EXECUTION

##### 3.01 EXAMINATION

A Verification of Conditions: Verify that the following items have been completed prior to commencement of finish grading:

1. Rough Grading and sub-grade soil amendments.
2. Installation of stockpiled and import topsoil as required and soil preparation including debris removal.

3. Incorporation of soil amendments.

### 3.02 LAYOUT

- A. Lines and Elevations: Establish lines and elevation markers by survey instrumentation for finish grades and locations.
- B. Provide all field surveying and calculations necessary to verify the subgrade, substrate and/or structural set-down elevations from the finish grades to earthwork grades. If any discrepancy is found notify the Owner's Representative in writing prior to commencement of finish grading.
- C. Provide additional grade stakes and string lines as required to achieve grades and to enable field observations by the Landscape Architect. Re-instate markers/stakes as required throughout the works. The Landscape Architect may direct the layout of the more important landform elements and/or shall review the works when laid out and retains the right to adjust the layout within 2 days.

### 3.03 FINISH GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Grade with constant slope between points where elevations are given.
  3. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
  4. Slope grades to direct water away from buildings to drains or subdrains and to prevent ponding.
- B. Landforms, slopes, mounds and planes of earthwork shall be reviewed and approved by Landscape Architect for conformance to drawings prior to final completion.

### 3.04 TOLERANCES

- A Comply with tolerances for lawn, grass and planting areas as follows:
  1. Elevation: 1/2 inch.
  2. Surface smoothness: Gap below 10-foot long straight edge not to exceed 1 inch in any direction.
  3. Slope: unless otherwise noted on the Drawings not less than 1% fall.
- B Comply with tolerances for pavement and building areas as follows:
  1. Surface smoothness: Gap below 10-foot- (3-m-) long straightedge not to exceed 1/4 inch in any direction.

2. Slope: unless otherwise noted on the Drawings not less than 1% fall.
3. Hold finished grades below top of adjacent pavement as follows: 1/2 inch at lawn and groundcover areas. Hold finished grades below top of adjacent headers, curbs, mowbands or walls as follows: 1 inch at lawn areas and 1 1/2 inch at groundcover areas or as indicated on Drawings.

### 3.05 ADJUSTING EXISTING UTILITY FEATURES

- A Adjust existing utility surface features to suit finish grade. Extend or reduce risers, boxes, chambers, basins and rings and reset castings, frames, grout beds, access doors, lids, covers and the like.

### 3.06 FINISHED GRADING ADJUSTMENT

- A After finish grading operations have been completed, allow for a crew of 4 workers over an eight-hour period (32 hours total) to adjust grading at the direction of the Landscape Architect.

### 3.07 PROTECTION

- A Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  1. Scarify or remove and replace soil material to depth as directed by Landscape Architect; reshape and recompact.
- C Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.08 DISPOSAL

- A Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 02320  
STRUCTURAL SOIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Structural Soil sub-base material and installation.
  - 2. Structural soil occurs at trees planted in tree grates within the park.
- B. Work specified elsewhere:
  - 1. Earthwork: Section 02200
  - 2. Finish Grading: Section 02310
  - 3. Planting: Section 02930
  - 4. Site Furnishings: Section 02870

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
- B. Excavation: Removal of material encountered above subgrade elevations.
  - 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- C. Fill: Soil materials used to raise existing grades.

- D. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- E. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and unit paving or concrete pavement.
- F. Sub-grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials.
- G. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Contractor Qualifications: Submit the Landscape or Pavement Contractor's qualifications outlining projects of similar quality, schedule requirements and construction detailing over the last five years. Qualifications shall include: the names of all similar projects, year completed, location, description of the scope of work including the types and quantities of planting mix/pavement material installed.
- B. Samples: Representative samples of the structural soil materials with documentation showing their conformance to the specifications including certified tests from the manufacturer.
  - 1. Submit two one half cubic foot samples each of the clay loam and the crushed rock to be used in the CU-Soil™ for testing, analysis and approval.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated: (All testing and analysis shall be at the expense of the contractor)
  - 1. The clay loam soil will be tested for the following:
    - a. Physical properties and USDA Classification
    - b. PH
    - c. Percent organic matter by dry weight.
    - d. Nutrient levels by ppm
    - e. Toxic elements and compounds.
    - f. Soluble Salt (ECE)
    - g. Cation exchange capacity (CEC)
    - h. Carbon/Nitrogen ratio.
  - 2. The crushed stone will be tested for the following:
    - a. Physical properties (Size)
    - b. Specific Gravity

3. A representative sample of the finished CU-Structural soil will be tested for the following:
  - a. California Bearing Ratio of 50 or greater.
  - b. Measured dry weight of stone in mixture.
  - c. The approved sample will be the standard for any further quality control testing as may be required by the engineer.

## 1.5 QUALITY ASSURANCE

- A. Structural Soil: The structural soil supplier must be a licensed producer of CU-Structural Soil™ from Amereq, Inc.
- B. Qualifications of Landscape or Pavement material Contractor: The work of this section shall be performed by a Contracting firm which has a minimum of five years experience successfully installing base material and/or planting mix of a similar quality, schedule requirement and construction detailing to this project.
- C. Soil Testing Agency Qualifications: An independent testing agency, acceptable to Architect, qualified to conduct soil materials testing as documented in applicable ASTM standards.
- D. Preinstallation Conference: Conduct conference at Project site prior to delivery and installation of materials to comply with requirements in Division 1.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver or place soils in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T99 (ASTM D 698). Do not deliver or place materials in an excessively moist condition (Beyond two percent above optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698).
- B. Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL SOIL: CU-Structural Soil™ by licensed supplier:

- A. Licensed supplier:  
TMT Enterprises, Inc.  
1996 Oakland Road  
San Jose, CA 95131

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
CMG Landscape Architecture

STRUCTURAL SOIL  
02320-3  
11/10/2014

Phone: 408-432-9040  
Fax : 408-432-9429

- B. CU-Structural Soil™: A uniformly blended mixture of crushed Stone, Clay Loam and Hydrogel, mixed to the following proportion:

|                |  |
|----------------|--|
| Crushed Stone  | 100 units                              |
| Clay Loam Soil | 20 Units                               |
| Gelscape       | .03 Units                              |
| Water          | As needed for soil to adhere to stone. |

## 2.2 CLAY LOAM

- A. General: Clay Loam shall be a "loam" based on the "USDA classification system" as determined by mechanical analysis (ASTM D-422) and it shall be of uniform composition, without admixture of subsoil.
- B. Mechanical Analysis of clay loam shall be as follows:
- |                |                   |
|----------------|-------------------|
| Textural Class | % of Total Weight |
| Gravel         | less than 1%      |
| Sand           | 20-50%            |
| Silt           | 20-50%            |
| Clay           | 20-40%            |
- C. Chemical Analysis should meet or be amended to meet the following criteria:
1. pH 5.5-7.5
  2. Organic Matter, 2-5% by dry weight.
  3. Soluble Salt less than 1.0 Millimho per cm.
  4. Toxic elements and compounds below the United States Environmental Protection Agency Standards for Exceptional Quality sludge or local standard; whichever is more stringent.
- D. Commercial fertilizers to be added will be of the type and application rates recommended by the soil-testing laboratory based on the type of plant material to be installed in the soil.

## 2.3 CRUSHED STONE

- A. Crushed Stone shall be ½" to 1 1/2" highly angular crushed granite with no more than 10% passing the ½" sieve meeting the following criteria:

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
CMG Landscape Architecture

STRUCTURAL SOIL  
02320-4  
11/10/2014

|       |              |   |
|-------|--------------|---|
| 2"    | 100% Passing |   |
| 1.5"  | 94%          | " |
| 1"    | 43%          | " |
| .75"  | 12%          | " |
| .50"  | 7%           | " |
| .375" | 4%           | " |
| #4    | 2%           | " |

Specific Gravity=2.78

2.4 HYDROGEL: Hydrogel shall be Gelscape™ as manufactured by Amereq, Incorporated of New City, NY. Phone: 800-832-8788.

## 2.5 GEOTEXTILES

A. Drainage Fabric: Non-woven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
2. Tear Strength: 40 lbf ; ASTM D 4533.
3. Puncture Resistance: 50 lbf ; ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
5. Apparent Opening Size: No. 50 ; ASTM D 4751.

B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf ; ASTM D 4632.
2. Tear Strength: 75 lbf ; ASTM D 4533.
3. Puncture Resistance: 90 lbf ; ASTM D 4833.
4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D 4491.



5. Apparent Opening Size: No. 30 ; ASTM D 4751.

## PART 3 - EXECUTION

### 3.1 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

- A. Notify the Architect of any subsurface conditions, which will affect the Contractor's ability to complete the work.
- B. Locate and confirm the location of all underground utility lines and structures prior to the start of any excavation.

### 3.2 SITE PREPARATION

- A. Excavation: Excavation for structural soil areas shall be as per Section 2 "Earthwork". Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the Drawings. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.
- B. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the drawings.
- C. Do not proceed with the installation of Structural Soil until all utility and irrigation system work in the area has been installed. All subsurface drainage systems shall be operational prior to installation of Structural Soils.

### 3.3 INSTALLATION OF STRUCTURAL SOIL MATERIAL

- A. Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. (As needed)
- B. Install Structural Soil in 6-inch lifts and compact each lift. Install to depth and width around tree as indicated on the Drawings.
- C. Compact all materials to peak dry density from a standard AASHTO compaction curve (AASHTO T 99). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction 24 hours if moisture content exceeds maximum allowable.
- D. Grading: Bring Structural Soils to finished grades as shown on the Drawings and according to "Earthwork" and "Finish Grading".
- E. The Landscape Architect may periodically check the material being delivered and installed at the site for color and texture consistency with the approved sample provided by the

Contractor as part of the submittal for Structural Soil. In the event that the installed material varies significantly from the approved sample, the Landscape Architect may request that the Contractor test the installed Structural Soil. Any soil, which varies significantly from the approved testing results, as determined by the Landscape Architect, shall be removed and new Structural Soil installed that meets these specifications.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test structural soil backfill. Proceed with subsequent structural soil installation only after test results for previously completed work complies with requirements.
- C. Testing agency will test compaction of structural soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Tree Pits: At subgrade and at each compacted layer, at least one test for every tree pit.
- D. When testing agency reports that structural soils have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace structural soil to depth required; recompact and retest until specified compaction is obtained.

### 3.5 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

### 3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02320

## SECTION 02325

### SWALE BIORETENTION SOIL AND CHECK DAMS

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. Section includes (but is not necessarily limited to):
- B. Furnishing and installing Swale Bioretention Soil in the locations shown on the drawings.
- C. Furnishing and installing Check Dams in the locations shown on the drawings.
- D. Related Sections:
  - 1. Submittal Procedures, Section 01330.

##### 1.2 DEFINITIONS

- A. Existing Topsoil: Area of undisturbed existing soil where no additional rough grading is to be done. No topsoil is to be placed. Only surface cultivation and soil amending are included in this Section.
- B. Subgrade: Soil level below topsoil resulting from the rough grading work under another Section. Cultivation of all subgrade areas prior to amending is included in this section.

##### 1.3 SUBMITTALS

- A. The Contractor must provide submittals to the Landscape Architect for approval prior to delivering any soil products to the site.
- B. A sample of mixed Swale Bioretention Soil.
- C. Certification from the soil supplier or an accredited laboratory that the Swale Bioretention Soil meets the requirements of this guideline specification.
- D. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
- E. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in Section 1.4.

- F. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
- G. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
- H. A description of the equipment and methods used to mix the sand and compost to produce Swale Bioretention Soil.
- I. Provide the following information about the testing laboratory(ies) name of laboratory(ies) including:
  - 1. contact person(s)
  - 2. address(es)
  - 3. phone contact(s)
  - 4. e-mail address(es)
  - 5. qualifications of laboratory(ies), and personnel including date of current certification by STA, ASTM, or approved equal

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer whose work has resulted in successful installation of bioretention soil.
- B. Swale Bioretention Soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Swale Bioretention Soil shall also support vigorous plant growth.
- C. Acceptance Criterion for Materials and Workmanship: The Landscape Architect shall inspect all materials and workmanship for compliance with the plans and specifications. Acceptance of all materials and workmanship is at the discretion of the Landscape Architect. Tests: Right is reserved to take samples of soil mixes and prepared soil for testing for conformity to Specifications.

### PART 2 - PRODUCTS

#### 2.1 SAND FOR SWALE BIORETENTION SOIL

- A. General - Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be non-plastic.
- B. Sand for Swale Bioretention Soil Texture
  - 1. Sand for Swale Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

| Sieve Size | Percent Passing (by weight) |     |
|------------|-----------------------------|-----|
|            | Min                         | Max |
| 3/8 in     | 100                         | 100 |
| No. 4      | 90                          | 100 |
| No. 8      | 70                          | 100 |
| No. 16     | 40                          | 95  |
| No. 30     | 15                          | 70  |
| No. 40     | 5                           | 55  |
| No. 100    | 0                           | 15  |
| No. 200    | 0                           | 5   |

Note: All sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

## 2.2 COMPOSTED MATERIAL FOR SWALE BIORETENTION SOIL

- A. General - Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).
- B. Compost Quality Analysis - Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify:
  1. Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
  2. Organic Matter Content: 35% - 75% by dry wt.
  3. Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
  4. Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability:
    - a. Oxygen Test < 1.3 O<sub>2</sub> /unit TS /hr
    - b. Specific oxy. Test < 1.5 O<sub>2</sub> / unit BVS /
    - c. Respiration test < 8 C / unit VS / day
    - d. Dewar test < 20 Temp. rise (°C) e.
    - e. Solvita® > 5 Index value

5. Toxicity: any one of the following measures is sufficient to indicate non-toxicity.
  - a. - : NO<sub>3</sub>-N < 3
  - b. Ammonium < 500 ppm, dry basis
  - c. Seed Germination > 80% of control
  - d. Plant Trials > 80% of control
  - e. Solvita® > 5 Index value
6. Nutrient Content: provide analysis detailing nutrient content including N P K, Ca, Na, Mg, S, and B.
  - a. Total Nitrogen content 0.9% or above preferred.
  - b. Boron: Total shall be <80 ppm; Soluble shall be <2.5
7. Salinity: Must be reported; < 6.0 mmhos/cm
8. pH shall be between 6.5 and 8. May vary with plant species.
- C. Compost for Swale Bioretention Soil Texture: Compost for Swale Bioretention Soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

| Sieve Size | Percent Passing (by weight) |     |
|------------|-----------------------------|-----|
|            | Min                         | Max |
| 1 inch     | 99                          | 100 |
| 1/2 inch   | 90                          | 100 |
| 1/4 inch   | 40                          | 90  |
| No. 200    | 2                           | 10  |

- D. Bulk density: shall be between 500 and 1100 dry lbs/cubic yard
- E. Moisture Content shall be between 30% - 55% of dry solids.
- F. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1% by weight or volume.
- G. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.
- H. Select Pathogens: Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
- I. Trace Contaminants Metals (Lead, Mercury, Etc.) Product must meet US EPA, 40 CFR 503 regulations.

- J. Compost Testing - The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, [www.compostingcouncil.org](http://www.compostingcouncil.org)). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

## 2.3 SWALE BIORETENTION SOIL MIX

- A. Swale Bioretention Soil shall be a mixture fine sand and compost, measured on a volume basis:  
60% - 70% Sand  
30% - 40% Compost

## 2.4 ROCK FOR CHECK DAMS

- A. Rock material certifications are required for gradation of each class of rock and for apparent specific gravity (2.65 minimum by CA 206), absorption (4.2 percent maximum by CA 206), durability index (52 minimum by CA 229) and abrasion loss (25 percent maximum 100 rev. by ASTM C535).
- B. All rock used shall be quarry rock, angular, close grained, and hard. Rock shall be free of seams or thin layers of soft or decomposed material to the end that it will not shatter, disintegrate, break down, or open up on dumping or exposure to weather or water action.
- B. Rock shall conform to the following gradation Classes

| Rock Sizes   | Gradation for Classes<br>(% larger than) |             |
|--------------|--|-------------|
|              | ¼ Ton                                    | Light Class |
| ½-Ton        | 0-5                                      | -           |
| ¼-Ton        | 50-100                                   | 0-5         |
| Light Class  | -  | 50-100      |
| Facing Class | 95-100                                   | -           |
| 25 lb        | 100                                      | 95-100      |
| 5 lb         | 100                                      | 100         |

## PART 3 – EXECUTION

### 3.1 SWALE BIORETENTION SOIL

- A. Protect subgrade soil in the swale area from compaction by using lightweight equipment, exclusion fencing, and/or laying down ½-inch sheets of plywood prior to driving on these areas. The Contractor shall not park or store equipment or materials on swale area.

- B. Drainage shall be directed away from the swale area until upslope areas are stabilized, unless approved by the Landscape Architect.
- C. If Swale Bioretention Soil is mixed onsite, the Contractor shall use an adjacent impervious area (asphalt) or shall protect pervious pavers with plastic sheeting to preserve perviousness.
- D. Swale Bioretention Soil shall not be placed during wet or saturated conditions.
- E. Equipment shall not be operated inside the bioretention planter.
- F. Grade Tolerance for Swale Bioretention Area: Finished grade elevations for the bioretention area shall be within  $\pm 0.1$  foot of the elevations specified on the plans. Grades between contour lines shall be uniform. The Contractor shall demonstrate, at the request of the Landscape Architect, that the bioretention area was graded in accordance with the plans within the tolerance levels and specifications contained herein. Finished grade shall be smooth and free of irregularities such as ridges and ruts that impart a "constructed" or "artificial" appearance.
- G. Place Swale Bioretention Soil in 12" lifts.
- H. Swale Bioretention Soil lifts shall be allowed to settle with boot packing (walk around on the soil to firm) lifts to achieve 85% compaction effort.
- I. The Contractor may settle Swale Bioretention Soils by lightly watering until soils are just saturated. Soil shall be allowed to dry for at least 24 hours between lifts, unless approved by the Landscape Architect.
- J. Seven (7) days after all lifts are placed, the Contractor shall check the Swale Bioretention Soil for settlement and add additional media as needed to achieve finish grade.
- K. After spreading has been completed, large clods, stones larger than one-inch in any dimension, roots stumps, and other litter shall be raked up and removed.
- L. The Contractor shall remove and dispose of all excess materials resulting from the finish grading of the Swale Bioretention Soil. The work required to remove and dispose of this excess material will be considered incidental to other work under the contract.

### 3.2 ROCK FOR CHECK DAMS

- A. Rock structures shall be constructed in conformance with S.S. Section 72-2 Rock Slope Protection, except that local surface irregularities (section 72-2.03 placing) for bedding material and gravel shall not vary from the planned slope by more than 0.5 foot.



- B. Place rocks for check dams so that it forms a dense, well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled placement with a back-hoe or other equipment during final placement.
- C. The contractor shall fill voids in rock structures with native soil material. Fill shall be placed in conjunction with placement of rock layers. Upon completion of each layer of stone, fill shall be compacted and vibrated into place to fill the voids. The contractor shall endeavor to completely fill all voids, using necessary methods. It may be necessary to mix water and/or gravel into fill material to facilitate movement into the voids. Water jetting of the fill material is not recommended. Hand placing may be necessary to achieve the proper distribution of stone sizes to produce a relatively smooth, uniform surface. Placement of fill in voids shall not interfere with the rock placement requirements as specified in S.S. Section 72. In particular, care shall be taken to maintain 3-point contact for rock layers.
- D. The toe of the check dams shall be keyed 6 inches to a stable foundation at its base.
- E. Place the check dams to the full thickness and height in one operation. Do not place rock for check dams by dumping through chutes or other methods that cause segregation of stone sizes. Take care not to dislodge the underlying base or filter when placing the stones.

END OF SECTION

## SECTION 02502

### STREET WORK NOT IN CONTRACT DAMAGED BY SUBCONTRACTOR

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This Section includes specifications for restoring any street work not in the Contract that has been damaged or removed by the Contractor's operations.
- B. This work includes, but is not limited to, asphalt and concrete pavement and related improvements, such as sidewalk, curb, gutter, parking strip, side sewer vents and traps, City- or Navy-owned frames and castings, and any other improvements not designated for removal or relocation.
- C. The street restoration work shall be at the Contractor's expense.

##### 1.2 REFERENCE STANDARDS

- A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), dated November, 2000.
- B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering, dated April, 2007.

The following exceptions to the Standard Plans shall be made.

Plan:

B-30,705.1 CH.3 AWSS-Methods of Resetting Castings and Cistern Rings.  
(Except that asphalt concrete and concrete base outside the limits of the system supporting the casting shall be 2 inches and 8 inches, respectively.)

- C. State of California Department of Transportation Standard Specifications (CTSS), dated July, 1992.

##### 1.3 SUBMITTALS

- A. The Contractor shall submit eight (8) copies of the manufacturer's literature, specifications, applications and installation instructions for Carbon Black (Grey or Charcoal color) for curb ramps for the Engineer's approval.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Asphalt concrete pavement shall be restored with 8-inch thick concrete base and 2-inch thick asphalt concrete wearing surface.
- B. Granite curb, armored curb or concrete curb shall be reconstructed with concrete curb.
- C. Concrete sidewalk shall be restored with 3-1/2-inch thick concrete sidewalk to the nearest flagline.
- D. Concrete curb ramp shall be restored to meet ADA requirements and per typical curb ramp plans CR-1 through CR-7, latest revisions.

## PART 3 - EXECUTION

### 3.1 SPECIAL INSTRUCTIONS

- A. Any damage to work or property by the Contractor shall be repaired per Section 105.03 of the SSDPWSF.
- B. Existing San Francisco Fire Department (SFFD) and existing San Francisco Water Department (SFWD) valves are to be accessible at all times.

### 3.2 INSTALLATION

- A. Sidewalk shall be restored to match existing sidewalk in design, color, and material and to existing whole flag lines.
- B. All street work restored by the Contractor shall be in accordance with the following conditions:
  - 1. Asphalt Concrete Wearing Surface: In accordance with Section 02510, "Asphalt Concrete Paving."
  - 2. Portland Cement Concrete Paving: In accordance with Section 02520, "Portland Cement Concrete Paving."
  - 3. Side Sewer Vent and Trap: In accordance with the requirements of Section 318 of SSDPWSF.

END OF SECTION

SECTION 02536  
PUBLIC STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.0 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

1.1 WORK INCLUDED

A. Section includes (but is not necessarily limited to):

1. Installation of public storm drain pipe, catch basins, manholes, sand traps and appurtenances in the Public Right of Way or Public Utility Easement.

2. Testing

B. Comply with all other provisions of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 02225, "Excavation, Backfilling and Compacting for Utilities"

1.3 QUALITY ASSURANCE

A. All testing shall be witnessed by the Owner's Agent and the City. Retesting required as a result of failed tests shall be at the Contractor's expense.

1.4 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

## 1.5 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings, and literature for each equipment item to be furnished under this Section, with all exceptions to the Specifications noted. Provide submittals for:

1. Pipe (including gaskets), Structures, and Fittings

## PART 2 - PRODUCTS

### 2.1 GENERAL

A. Separated storm drainage structures and materials shall be per requirements for combined sewer systems as described in Part 3, 'Sewerage and Drainage', of the City Standard Specifications, and as indicated in the City Standard Plans, except as modified herein, or as otherwise detailed on the Project Drawings.

### 2.2 SEPARATED STORM DRAINAGE MATERIALS

A. Storm drain pipe:

Storm drain pipe, larger than 24" inside diameter, shall be reinforced concrete pipe (RCP), ASTM C76, Class IV, having bell and spigot joints with Neoprene rubber gaskets, unless otherwise noted. Storm drain pipe, 24" and smaller inside diameter, shall be HDPE SDR 17 conforming to ASTM D3035 or reinforced concrete pipe (RCP), ASTM C76, Class IV, having bell and spigot joints with Neoprene rubber gaskets, unless otherwise noted. All RCP shall conform to Section 304, SSDPWSF.

B. Couplings and Flexible Joints:

1. Couplings and Flexible Joints for RCP shall consist of a fabricated steel coupling joining two ends of pipe meeting provisions of ANSI/AWWA C219-97 and having the following characteristics:

- a. Middle ring of ASTM A36, min. yield 36k psi
- b. Follower rings of ASTM A576/ASTM A36

c. Gaskets of NSF-61 Buna-S/SBR/Gr. 30/Gr. 27 per ASTM D2000/AWWA C-111/C-219

d. Bolts of Type 316 SST w/ heavy hex nuts

e. Lining and Coating of NSF Std. 61 Fusion Bonded Epoxy, 12 mils min. dft applied per AWWA C-213

f. Baker Coupling Series 200/212, Romac Series 400, or approved equal.

g. Paint cut ends of RCP with epoxy paint to protect exposed reinforcement.

2. Flexible Joints for RCP may also consist of standard bell and spigot joints with Neoprene rubber gaskets.

C. Connections of HDPE to HDPE shall be made by electrofusion of the pipe ends, the use of electrofusion couplings, or heat fusion in accordance with ASTM F2620.

D. Service laterals up to 12" diameter shall be HDPE with SDR of 17, and shall connect to main as indicated on the Project Drawings. Storm drain laterals larger than 24" shall be RCP per paragraph 2.2.A.

E. Submittals for type of pipe and fittings to be submitted to DPW/ITF for City review and approval.

F. Fittings for cleanouts shall be Ductile Iron Pipe with Neoprene rubber gaskets. Clean out boxes shall be Christy G5 Box with G5C lid and vandal resistant hold-down option, marked with appropriate utility description.

G. Manhole frame and cover shall be D&L Foundry A-1024 or South Bay Foundry SBF 1900 CPH. Manhole covers for Separated Storm Drain manholes shall be marked "Storm Drain".

H. Perforated pipe for tree trench drains and flow through planter sub-drains shall be 4" diameter dual wall PE pipe. All perforations shall be slotted type and conform to AASHTO Class II specifications and measure 0.125 inch thick by 0.875 inch long, providing a minimum inlet area of 1.0 square inch per linear foot of pipe. For tree trench drains beyond the limits of structural soil, drain pipe shall be non-perforated pipe meeting the same specification. Fittings shall match strength of pipe.

I. Catch basins shall be Caltrans style precast box with cast-in-place gutter apron and curb.

Provide bicycle proof grate as indicated on Project Drawings.

J. Flared End Sections shall be precast concrete.

K. Manhole bases may be precast concrete, as approved by Owner's Agent and CCSF. Walls shall be designed to avoid pipes entering within 8" of wall joints. Precast bases must be grouted to form smooth channels connecting inlet and outlet pipes.

L. Elastomeric bearing pads used at pipe-to-manhole connections per CCSF Standard Plan 48,057 may be substituted with Hydrotite DSS-0420, or accepted equal.

## 2.3 SAND TRAP

### A. Base

1. Base shall be a storm water inlet per City Standard Specifications and City Standard Plans, except as modified herein.

### B. Lid

1. Lid shall be an architectural vault cover rated at 150 psf, and stamped, or otherwise marked, "PUBLIC STORM DRAIN".

## PART 3 - EXECUTION

### 3.1 GENERAL

A. Installation of storm drainage pipe and structures shall conform to requirements of Part 3, 'Sewerage and Drainage', of the City Standard Specifications.

### 3.2 STORM DRAIN FACILITIES

A. The invert slope of the pipe shall be uniform between two invert/conform elevations of sewer facilities. Field adjustment of slope may be necessary after verification by the contractor of the invert/conform elevations of sewers or sewer structures. The descending order of precedence shall be as follows:

1. Invert Elevation
2. Invert Conform Elevation
3. Slope
4. Existing Elevation
5. Approximate Elevation

B. Flexible Joints:

1. Flexible Joints shall be installed at each manhole connection, located as shown on SPDPWSF File No. 87,181, 87,182, and 87,183. Flexible Joints are not required at HDPE pipe-to-manhole connections.
2. Additional flexible joints shall be installed where indicated on the Construction Documents.

C. Contractor shall provide bypass plan for review and approval by CCSF for connection to any existing Combined Sewer or Storm Drain main.

D. At catch basins, connection of the 10" storm drain lateral to the cast iron trap shall be made with rubber compression coupling meeting the requirements of ASTM C425, incorporating grade 316 stainless steel band clamps.

E. All new work including manholes shall be tested at no additional expense to Owner or City. Testing shall be in conformance with City Standard Specifications, Section 319, with 72 hours advance notice to Owners Agent and the City. HDPE pipe shall be tested in conformance with ASTM F 1417-92 "Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air."

All manholes shall be vacuum tested and shall meet the requirements of ASTM C1244 prior to acceptance. Manholes shall be tested prior to backfill. The contractor may propose, in writing, to test manholes after backfill. If approved by the Owner's Agent, in writing, manholes may be tested after backfill is complete. However, should the manholes fail the vacuum test after backfill has occurred, the contractor shall be responsible for any and all costs associated with the re-excavation of the manholes in order to perform repairs or warranty work and the cost of retesting.

F. In addition to above testing, provide video inspection by an approved television



video inspection service in accordance to Appendix B at no cost to Owner or City. Contractor to perform post-construction video inspection of existing laterals and existing connecting mains (e.g. side sewers and culverts) up to vents and/or catch basins within the public right-of-way for submittal to City for review. If lateral or connecting main is shown to be inoperable, Contractor to replace with new. Replacement work to be done under separate Change Order unless damaged is shown to be caused by Contractor. The contractor is responsible for obtaining asset numbers for all new and existing manholes and pipes from Mr. Alan Liu, SFPUC Sewer Operations, [aliu@sfgwater.org](mailto:aliu@sfgwater.org) / 415-641-2372, 160 Napoleon Street, San Francisco, CA 94124, by advance appointment between the hours of 6:30 AM and 3:00 PM Monday through Friday.

G. All HDPE pipe 12" or greater shall be deflection tested. Maximum installed deflections of HDPE pipe shall be five percent (5%) of mean internal diameter. Contractor shall provide mandrel deflection testing equipment and labor. Pipe exceeding deflection limits shall be replaced or re-compacted at contractor's expense.

H. No repairs shall be undertaken without prior written notice and repair proposal to Owner's Agent and the City.

I. For installations using HDPE pipe, the bead formed when sections of pipe are joined shall be immediately removed from the interior of the pipe per Manufacturer's recommendations.

J. Supply one additional manhole cover for each sub-phase or 10% of the total manhole covers in each sub-phase, whichever is greater.

END OF SECTION

SECTION 02660  
LOW-PRESSURE WATER SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

- A. Provide requirements for new water service for the buildings, including the new domestic and irrigation service, valves, meters, backflow preventers, cathodic protection, and accessories.

1.2 RELATED SECTIONS

Section 02225, "Excavation; Backfilling and Compacting for Utilities."

1.3 SUBMITTALS

- A. Product Data: Provide pressure rating, rated capacity, and settings of selected models for the following:
  - 1. Water meters.
  - 2. Backflow preventers.
  - 3. Valves.
  - 4. Identification materials and devices.

1.4 REFERENCES

- A. Standard Specifications of the City and County of San Francisco (the City), Department of Public Works (DPW), Bureau of Engineering (BOE), dated November, 2000. Also referred to as "City Standard Specifications."
- B. Standard Plans of the City, DPW, BOE, dated April, 2007. Also referred to as "City Standard Plans."
- C. DPW Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco," approved January 1, 1999.
- D. American Water Works Association (AWWA) Standards, Latest Revision.
- E. San Francisco Water Department (SFWD) standard drawings, SFWD Rules and Regulations governing water services to customers (Standard Drawings).
- F. CCR, Title 17 and 22. A copy of CCR, Title 17 and 22 can be found on the DES website located at <http://www.dhs.calmet.gov/ps/ddwem/publications/regulationsbluebook3-l1-02.pdf>.

- G. DHS' Draft Water Works Standards dated December 2, 2002. A copy of this document can be found on the DHS website located at <http://www.dhs.cahwnet.gov/ps/ddwem/publications/regulationstwaterworksregdraftl 2-10-02.pdf>. Also referred to as "Water Works Standards."
- H. DHS' California Safe Drinking Water Act and Related Laws, 7th Edition, January 1, 2000.
- I. San Francisco Public Utilities Commission (SFPUC) Water Quality Bureau (WQB) Standard Disinfection and Sanitary Work Practices, latest edition.

## PART 2 -- PRODUCTS AND APPLICATIONS

### 2.1 SERVICE PIPES

- A. Service pipes shall be copper tubing type K, soft or hard, for less than 2 inch sizes and ductile iron for larger sizes.
- B. Fittings shall be made of bronze or brass, in conformance with AWWA C-900.
- C. Service connection pipe and fittings shall be designed for cold water working pressure of not less than 150 pounds per square inch gage [psig, 1, 030 kilo-Pascal gage (kPag)] in accordance with Section 64644 of CCR Title 22. Copper tubing shall be commercial designation type K.
- D. All joints for ductile iron pipes and fittings shall be fastened to the pipe or to each other by use of Field-Lok g shall be fastened to the pipe by use of tie rods and lugs or restrainers as shown on SFWD Standard Drawing E-4969.

All tie rods, lugs, restraining ring assembly, bands and other miscellaneous metal attached to the pipeline and hydrant bury, installed by the contractor and by the Water Department during main connections, or large service connections shall be painted with two (2) coats of Kopper Bitumastic No. 505 or two (2) coats Protecto Wrap CA160, applied in accordance with the manufacturer's recommendations. Tie rods are to be SS-TP304 material.

### 2.2 GATE VALVES

- A. Gate valves shall be designed in accordance with AWWA C500-93. Gate valves shall be Mueller A-2362-RN-40-9020 or approved equal.
- B. Valves on service pipes 2 inches or less shall be "corporation stop" type and buried. Corporation stops shall be tapped into the main as shown on standard drawing.

- C. Valve boxes and covers shall be as per SFWD standard drawings.

## 2.3 DUCTILE IRON FITTINGS

- A. Use ductile iron fittings to connect ductile iron pipes. Ductile iron fittings conform to the latest revision of ANSI/AWWA C110/A21.10-98. Fittings are slip on fittings, manufacturer and model to be determined during submittal process.

## 2.4 JOINT RESTRAINT DEVICES

- A. Joint restraint devices shall be per SFWD standard drawings, except that bolt, nut and tie-rods shall be stainless steel TP304.

## 2.5 METER BOXES AND COVERS

- A. Meter boxes and covers for standard (domestic) services shall be made of polyethylene and polymer concrete: Meter boxes and covers shall be manufactured by Armorcast or equivalent.

## 2.6 BACKFLOW PREVENTER

- A. The type of backflow preventer shall be determined by the SFWD, Water Quality Bureau (WQB). The backflow preventer shall be designed and installed in accordance with Sections 7601, 7602, 7603, and 7604 of CCR Title 17, and City Ordinance 356— 84, Article 12A.

# PART 3 -- EXECUTION

## 3.1 LOCATION OF WATER LINES

- A. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer than 10 feet horizontally from any sewer line.
- B. Where water lines cross under gravity sewer lines, encase sewer line in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing,
- C. Where water lines cross sewer force mains and inverted siphons, install water line at least 2 feet above these sewer lines.
- D. When joints in the sewer line are closer than 3 feet horizontally from the water line, encase sewer line joints in concrete.
- E. Do not lay water lines in the same trench with other utilities.
- F. Install water lines as detailed on Drawings

### 3.2 INSTALLATION OF PIPE FITTINGS

- A. All fittings shall be installed in the manner specified for installing pipe under Item 3.1.
- B. Joints on all laterals to the main shall be restrained per SFWD standard drawing.

### 3.3 HYDROSTATIC PRESSURE TEST

- A. Pressure tests shall be performed by the contractor under SFWD supervision. Temporary anchors will have to be installed to prevent pipe movement during the test. Pipelines shall be tested to a hydrostatic pressure of 225 pounds per square inch (psi). The actual pressure test of 225 psi shall be maintained for at least 2 hours during which time no additional water shall be added to the line under test. Unless otherwise directed by the Engineer, the pipe joints shall be exposed during the test. All service lines to be incorporated in the pipeline shall be installed before the pipeline is tested and shall be included in the test. At locations where the operating pressure is greater than 150 psi, the test pressure shall be 1.5 times the operating pressure.
- B. If any section of the pipe being tested develops a leak that is visible to the eye in the rubber gasket joints or in the pipe itself, the defective joint or portion of pipe shall be repaired or replaced as directed by the SFWD at Contractor's expense. After all repairs are made, the pipe shall be retested:

### 3.4 DISINFECTION

- A. Upon completion of satisfactory hydrostatic test, the SFWD will disinfect the main at cost to the contractor. The SFWD will supply and install all piping, fittings and other materials necessary to chlorinate the main, except for screw taps and risers, which shall be installed by the contractor. The contractor shall not backfill the site of such work until the satisfactory disinfection of the main is verified by the SFWD. Refer to WQB's Standard Disinfection and Sanitary Work Practices provided as Attachment A.

### 3.5 INSTALLATION OF SHORING

- A. The contractor shall install an approved shoring system for all excavations five (5) feet or more in depth.
- B. All shoring shall be installed in accordance with Standards established by the State of California Occupational Safety and Health Administration (CAL/OSHA) and in conformance with all other applicable rules and requirements.
- C. In locations where the Water Department crews will install main or service connections, regardless of depth, the contractor shall install a solid sheeting type-shoring system, approved by the contractor that is capable of protecting all

excavations from excessive water that is present and give ample access to the crews to perform the installation. This shoring system is more stringent than Cal/OSHA Standards.

### 3.6 INSTALLATION OF SERVICE PIPES

- A. The allowable diameters for service pipes are 1, 2, 4, 6, 8, and 12 inches. Pipe diameters of 3 inches and less than 1 inch should not be used.
- B. New service to existing main connection. The SFWD shall install service pipe connections (corporation stop or isolation valve) to existing mains prior to service pipe installation at cost for the contractor.
- C. New service to new main connection. The contractor shall install service pipe connections to all new water mains.

### 3.7 INSTALLATION OF WATER METER

- A. The contractor shall install service pipe up to and excluding the meter. SFWD will install the meter. The contractor shall install house-pipe from the meter. The contractor shall install meter box and cover.
- B. Pipes installed by the contractor upstream of the meter shall be pressure tested before the installation of the meter by SFWD. Meters and meter boxes shall be installed near the curb, on the first flag on the sidewalk.
- C. Sizes of meter boxes shall be as shown hereinafter:

| Meter      | Size of Meter Box            |
|------------|------------------------------|
| 5/8" to 1" | 20" x 14" outside dimensions |
| 1-1/2"     | 27" x 18"                    |
| 2"         | 35" x 22"                    |
| 4" & 6"    | 36" x 80" x 30"              |
| 8" & 10"   | 36" x 90" x 30"              |

### 3.8 INSTALLATION OF LOCATING/MARKING TAPE

- A. The locating/marketing tape shall be installed in the trench continuously over the centerline of the pipe, 12" above the top of the pipe. The tape shall be oriented longitudinally, and centered along the top of the pipe, with the printed side facing up. Necessary precautions shall be taken to ensure that the tape is not twisted or misplaced during backfilling.

## ATTACHMENT A WQB STANDARD SPECIFICATIONS DRAFT 6-28-02

### SP-AI DRINKING WATER SYSTEM COMPONENTS

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
GHD

LOW-PRESSURE WATER SYSTEM  
02660-5  
11/10/2014

No chemicals, materials, products, or equipment supplied under this contract for the treatment or distribution of drinking water including, but not limited to, process media (carbon, sand), protective materials (coatings, linings, liners), joining and sealing materials (solvent cements, welding materials, gaskets, lubricating oils), pipes and related products (pipes, tanks, fittings), mechanical devices used in treatment/transmission/distribution systems (valves, chlorinators, separation membranes), and mechanical plumbing devices (faucets, endpoint control valves) shall be in contact with a drinking water unless the chemical, material, or product has been tested and certified as meeting the specifications of American National Standard Institute/NSF International(ANSI/NSF) Standard 61-2001/Addendum 1.0-2001 (Drinking Water Treatment Chemicals—Health Effects). This requirement shall be met under testing conducted by a product certification organization accredited for this purpose by the American National Standards Institute.

The contractor shall submit proof of ANSI/NSF Standard 61 certification for all chemicals, materials, products, or equipment supplied under this contract for the treatment or distribution of drinking water.

#### SP-A2 SANITARY WORK PRACTICES

The contractor shall install pipelines and appurtenances in a manner to prevent animal, physical, biological, and chemical contamination.

- A. The contractor shall establish sanitary controls in accordance with AWWA Standards C651-99, Section 4.3, Preventative And Corrective Measures During Construction.
- B. All domestic water pipelines shall be stored so that the ends are capped with removable plastic caps to prevent dirt or other foreign material from entering the system. Plugs of rags, wood, cotton or similar materials are not acceptable.
- C. All materials stored on site shall be kept in a clean and undamaged condition. Material shall be stored off the ground and away from any standing water. Valves and other appurtenances shall be kept wrapped in plastic or other protective material until installation.
- D. Prior to installation of any pipelines, valves, or appurtenances, all plugs, caps, dirt, debris, grease and foreign material shall be removed. If dirt has entered the pipe, contractor shall wash components with potable water.
- E. All equipment, facilities, and pipelines to be installed shall be kept clean subject to the approval of the Engineer. If the Engineer finds unacceptable care or cleanliness of facilities, the Engineer may require the facilities to be cleaned, at no charge to the City, prior to installation and/or being put into service.

#### SP-A3 DISINFECTION OF PIPELINES, PUMP STATIONS, AND WELLS

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
GHD

LOW-PRESSURE WATER SYSTEM  
02660-6  
11/10/2014

All pipelines pump stations, and -wells that convey potable drinking water shall be 'disinfected prior to being placed into service.

- A. After installation of pipelines and appurtenances, contractor shall conduct Field Testing per Section 3.5, Pressure Test. Following this task, SFPUC personnel will perform a final disinfection on facilities that convey potable drinking water. per AWWA Standards for the disinfection of pipelines, pump stations, or wells.
- B. The contractor shall notify the Engineer two weeks prior to a facility being ready for disinfection. The contractor shall coordinate construction activities with the Engineer for coordination with SFPUC personnel conducting the disinfection. The contractor shall assist and provide support, and equipment to the SFPUC as needed. The contractor shall be required to provide minor assistance to SFPUC personnel.
- C. Time allowance for disinfection, including filling, disinfecting, flushing, and bacteriological analysis of the facility shall be estimated in calendar days and provided to the City. If the specified bacteriological analyses are not satisfied, the disinfection procedure will be repeated until the requirements are met at no additional cost to the City.
- D. Bacteriological Analyses of Water. After completion of the disinfection procedure, the Engineer will obtain water samples for bacteriological analyses by the City. Requirements for satisfactory disinfection of water supply are that bacteriological analyses (heterotrophic plate) shall indicate that water samples are negative for coliform bacteria. If bacteriological analyses do not satisfy the above requirements, then disinfection procedures will be repeated until these requirements are met, at no additional cost to the City.

END OF SECTION



SECTION 02670  
RECLAIMED WATER SYSTEM

PART I -- GENERAL

1.1 SUMMARY

- A. Provide new reclaimed water irrigation system.
- B. All requirements of Section 02660, Low-Pressure Water System, apply to this section unless indicated differently in this section.

1.2 RELATED SECTIONS

- A. Section 02225, "Excavation, Backfilling and Compacting for Utilities."

1.3 REFERENCE STANDARD

- A. Standard Specifications of the City and County of San Francisco (the City), Department of Public Works (DPW), Bureau of Engineering (BOE), dated November, 2000. Also referred to as "City Standard Specifications."
- B. Standard Plans of the City, DPW, BOE, dated April, 2007. Also referred to as "City Standard Plans."
- C. DPW Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco," approved January 1, 1999.
- D. American Water Works Association' (AWWA) Standards, latest revision.
- E. San Francisco Water Department (SFWD) standard drawings, SFWD Rules and Regulations governing water services to customers.
- F. SFWD's Design Criteria and Standards - Low Pressure Domestic Water Design Criteria\_
- G. CCR, Titles 17 and 22. A copy of CCR, Title 17 and 22 can be found on the DHS website located at <http://www.dhs.cahnet.gov/ps/ddwem/publications/regulations/bluebook3-11-02.pdf>.
- H. DHS' Draft Water Works Standards dated December 2, 2002. A copy of this document can be found on the DHS website located at <http://www.dhs.cahnet.gov/ps/ddwem/publications/regulations/waterworksregdraft12-10-02.pdf>.
- I. DHS' California Health Laws Related to Recycled Water; also known as "The Purple Book," excerpts from the Health and Safety Code, Water Code, and Titles

17 and 22 of the CCR, dated June 2001.

- J. San Francisco Plumbing Code, latest revision.
- K. Department of Public Works (DPW) Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco," approved January 1, 1999.
- L. City and County of San Francisco Plumbing Code PART 2 – PRODUCTS

## PART 2 – PRODUCTS

### 2.1 PLASTIC WRAP

- A. Reclaimed water pipe shall be wrapped with purple plastic in accordance with AWWA C105/A21.5-99.

### 2.2 LOCATING/MARKING TAPE

- A. Provide locating/marketing tape in the trench, continuously over the centerline of the pipe. Color-coded identification tape differentiating the reclaimed water piping from other utility lines shall be consistent throughout the project. Reclaimed water pipes shall be installed with a purple identification tape of polyethylene vinyl wrap, such as Pantone 512 or equivalent. The identification tape shall be locator-type marking tape. The tape and wrap shall be at least three (3) inches wide and shall have white or black printing on a purple field with the following inscription: "RECLAIMED WATER – DO NOT DRINK," plus a universal icon for non-potable water. The text shall be separated by space of more than 6 inches. If the tape is wrapped around the pipe, there shall be two parallel rows of text so that the warning is readable after overlapping. Identification tape shall be continuous in coverage. If tape is attached to sections of pipe before they are placed in the trench, there shall be extra lengths of flaps to provide continuous coverage when the section is installed.

### 2.3 VALVES and VALVE BOXES

- A. Valves shall be epoxy coated and purple in color. Valves shall be identified with a stamped brass or engraved plastic disc not less than 1.5 inches in diameter that is permanently affixed to the valve with the inscription: "RECLAIMED WATER" plus a universal icon for non-potable water.
- B. Valve box shall be a ductile iron frame and a matching cover. Valve box assembly shall be as per the auxiliary water supply system (A WSS) standards for hydrant valve, in "City Standard Plans" book. Cover shall be triangular shape, with the following inscription cast on the top. "RECLAIMED WATER" plus a

universal icon for non-potable water.

## 2.4 RECLAIMED WATER METER

- A. Reclaimed water meter shall be purple in color. Meters shall be identified with a stamped brass or engraved plastic disc not less than 1.5 inches in diameter that is permanently affixed to the valve with the inscription: "RECLAIMED WATER" plus a universal icon for non-potable water.

## PART 3 -- EXECUTION

### 3.1 INSTALLATION OF RECLAIMED WATER

- A. The installation criteria for reclaimed water are the same as that for potable low-pressure domestic water except specified hereinafter.
- B. Reclaimed water lines shall maintain the minimum separation distances from potable water lines as the separation between a sewer line and a domestic water main in conformance with DIN' requirements contained in Section 64572 of the Draft California Water Works Standard and listed below.
  - 1. New water mains and new supply lines shall be installed at least 10 feet horizontally from, and one foot vertically above, any parallel pipeline Conveying:
    - a. Untreated sewage,
    - b. Primary or secondary treated sewage,
    - c. Disinfected secondary-2.2 recycled water (defined in Section 60361.220),
    - d. : Disinfected secondary-2.3 recycled water (defined in Section 60301.225), and
    - e. Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.
  - 2. New water mains and new supply lines shall be installed at least 4 feet. horizontally from, and one foot vertically above, any parallel pipeline conveying:
    - a. Disinfected tertiary recycled water (defined in section 60301.230), and
    - b. Storm drainage.
  - 3. New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

4. If crossing a pipeline conveying a fluid listed in subsection 1 or 2, a new water main shall be constructed perpendicular to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of the fluid pipeline.
  5. The vertical separation specified in subsections 1, 2, and 3 is required only when the horizontal distance between a water main and pipeline is ten (10) feet or less.
  6. New water mains shall not be installed within 100 horizontal feet of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 feet of any cesspool, septic tank, sewage leach field, seepage pit, or groundwater recharge project site.
  7. The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe.
- C. The locating/marketing tape shall be installed in the trench continuously over the centerline of the pipe, 12" above the top of the pipe. The tape shall be oriented longitudinally, and centered along the top of the pipe, with the printed side facing up. Necessary precautions shall be taken to ensure that the tape is not twisted or misplaced during backfilling.

### 3.2 HYDROSTATIC PRESSURE TEST

- A. Pressure tests shall be performed by the contractor. Temporary anchors will have to be installed to prevent pipe movement during the test. Pipelines shall be tested to a hydrostatic pressure of 225 pounds per square inch (psi). The actual pressure test of 225 psi shall be maintained for at least 2 hours during which time no additional water shall be added to the line under test. Unless otherwise directed by the Engineer, the pipe joints shall be exposed during the test. All service lines to be incorporated in the pipeline shall be installed before the pipeline is tested and shall be included in the test. At locations where the operating pressure is greater than 150 psi, the test pressure shall be 1.5 times the operating pressure.
- B. If any section of the pipe being tested develops a leak that is visible to the eye in the rubber gasket joints or in the pipe itself, the defective joint or portion of pipe shall be repaired or replaced as directed by the SFWD. After all repairs are made, the pipe shall be retested.

END OF SECTION

SECTION 02720  
PRIVATE STORM DRAINAGE SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

- A. Provide requirements for private storm drainage system in the locations and in conformance to the lines, grades and details indicated on the Drawings, and as specified.
- B. Private storm drain system includes, but is not limited to, the following items that are not located in the Public Right of Way or Public Utility Easement:
  - 1. Storm drain pipe
  - 2. Manholes, frames and covers
  - 3. Catch basins, frames and gratings

1.2 RELATED SECTIONS

- A. Section 02225, "Excavation, Backfilling and Compacting for Utilities."

1.3 REFERENCES

- A. Subdivision Regulations, adopted by the Department of Public Works (DPW) Resolution No. 124,677, Bureau of Engineering (BOE), DPW, City and County of San Francisco, January 6, 1982.
- B. Standard Specifications, DPW, BOE, revised November 2000 (Standard Specifications).
- C. Standard Plans, BOE, DPW, revised April, 2007 (Standard Plans).
- D. Start at the Source. Design Guidance Manual for Stormwater Quality Protection, prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) New Development Committee by Tom Richman and Associates, with Camp, Dresser, and McKee, and Professor Bruce Ferguson (University of Georgia), 1999.
- E. Department of Public Works (DPW) Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco," approved January 1, 1999.
- F. City and County of San Francisco Plumbing Code

#### 1.4 SUBMITTALS

- A. Contractor shall provide submittals of all products, including but not limited to pipe, manhole, drainage inlets, and grates, for Engineer and Owner to review. Sample product of each drain type shall be provided to Architect for approval.

### PART 2 — PRODUCTS

#### 2.1 GENERAL

- A. Structures, pipes, fittings, and materials shall be per requirements of Part 3, "Sewerage and Drainage," of the City Standard Specifications, and City Standard Plans, except as modified herein.
- B. Wall drains: Wall drains shall be installed as shown on the plans per manufacturer's recommendations. Wall drain shall be Miradrain 6000 or approved equal.

#### 2.2 STORM DRAIN PIPE

- A. Storm drains shall be Vitrified Clay Pipe (VCP), 12" diameter and over, per City Standard Plans and Specifications.
- B. Storm drains shall be Polyvinyl Chloride (PVC), less than 12" diameter, Schedule 40, ASTM D1785.
- C. Pipe anchors should be placed at bell joints to hold pipe in place.
- D. Perforated pipe shall be solvent weld Provide Polyvinyl Chloride (PVC) pipe conforming to ASTM D2729

#### 2.3 MANHOLES

- A. Manholes - Manholes shall be constructed in accordance with Standard Plans and Standard Specifications.
- B. Manholes built in reference to SFDPWSP # 87 and 181 shall negate sheet note #7 and install rebar as shown.

#### 2.4 CATCH BASINS

- A. Catch Basins — Catch basins shall be constructed in accordance with drawings and conforming to ASTM C 478, using Type II cement conforming to ASTM C 150.

1. Precast reinforced concrete catch basins may be furnished and installed in lieu of cast-in-place catch basin structures, when approved.
2. Provide precast reinforced catch basins with standard metal grate covers and side openings as indicated on Drawings.
3. Submit details for approval prior to ordering precast concrete catch basins, inlets, grates, covers, and frames.

## 2.5 AREA DRAINS

- A. Area drains shall be constructed in accordance and location shown on the drawings. Area drains shall be NDS Duracast In-Line D12H-WO or NDS Brass and Chrome 918B, as shown on the drawings, or approved equal. Secure all drain covers with tamper proof hardware. All drain covers to be slip resistant.

## 2.6 TRENCH DRAINS

- A. Trench drains shall be constructed in accordance and location shown on the drawings. Trench drains shall be Neenah R-4999-BX, Type C as shown on the drawings or approved equal. Secure all drain covers with tamper proof hardware. All drain covers to be slip resistant

## 2.7 OVERFLOW DRAINS

- A. Provide overflow drain as shown on Drawings. Drain shall be NDS No 90B or approved equal. Drain shall be 6" round atrium grate for 6" pipe, made of brass with open surface area of 28.4 square inches, 37.2 GPM. Drain shall have locking mechanism.

## 2.8 WALL DRAINS

- A. Provide MiraDRAIN 6000 at overlook structure and seat walls as shown on Drawings.

# PART 3 — EXECUTION

## 3.1 GENERAL

- A. Installation of sewers and structures shall conform to requirements of Part 3, "Sewerage and Drainage," of the City Standard Specifications.
- B. Installation of side sewer connection shall be per section\_ 316 of City Standard Specifications and Standard Plan Drawings 44,337 and 44,851.

### 3.2 STORM DRAINS

- A. Location - Storm drains shall be as shown on plans.
- B. Settlement - Pipelines shall comply with the construction documents both at the time of construction and after 100% of the predicted fifty (50) year settlement.

### 3.3 INSTALLATION — GENERAL

- A. Placing Pipe:
  - 1. Examine each pipe; do not use defective or damaged pipe.
  - 2. Pipelines shall be laid to the grades and alignment indicated on the Drawings.
  - 3. Provide proper facilities and equipment for lowering sections of pipe into trenches.
  - 4. Do not lay pipe when trench conditions or weather are unsuitable for such work. Do not lay pipe in water.
  - 5. Provide diversion of drainage or dewatering of trenches during construction as necessary.
  - 6. Installation of concrete pipe shall precede upgrade, with the spigot ends of bell-and-spigot pipe and the tongue ends of tongue-and-groove pipe pointing in the direction of the flow.
  - 7. Install circular concrete pipe with elliptical reinforcing so that the reference lines designating the top of the pipes will be not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe.
  - 8. In backfilling operations exercise care to prevent damage to or misalignment of the pipe.
  - 9. Adjust spigots in bells and tongues in grooves to produce a uniform space.
    - a. Blocking or wedging between bells and spigots or tongues and grooves will not be permitted.
    - b. Provide pipe of correct length; replace any pipe or fitting that does not allow sufficient space for proper installation of caulking or joint material.
  - 10. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads.
  - 11. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated on Drawings. Laser beam method may be used in lieu of



batterboards for the same purpose.

### 3.4 CATCH BASINS

- A. Catch basins shall be provided at all low points and shall be so located in the gutter as to most effectively serve the adjacent drainage area.
- B. Catch basins shall be constructed in accordance with drawings

### 3.5 DRAINAGE STRUCTURES AND MANHOLES

- A. Construct base slab of cast-in-place concrete.
  - 1. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
  - 2. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit.
  - 3. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab.
  - 4. For precast concrete construction, make joints between sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping.
- B. Provide a smooth finish to inside joints of precast concrete manholes, curb inlets, and catch basins, Parging will not be required for precast concrete manholes.
- C. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer.
- D. Where a new manhole is constructed on an existing line, remove existing pipe as required to construct the manhole.
  - 1. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding beyond into the manhole.
  - 2. Make pipe connections to manholes per City Standard Specification 305.02.
- E. Manhole Construction - Excavate, install and backfill manholes as specified.
  - 1. All embedment materials under, around; and at least 3 inches over all pipelines located within 5 feet of structure bases shall be compacted without jetting prior to barrel section placements.
  - 2. Construct manholes to subgrade prior to jetting adjoining sewer pipeline

trench and/or structure backfill where such method of compaction is permitted and used.

- F. Provide structures constructed with precast sections of a single manufacturer and/or with such compatible products as recommended by the precast manufacturer.
- G. Installation of Gaskets:
  - 1. Apply 1 coat of primer to clean, dry joint surface (both tongue and groove) and allow to dry.
  - 2. Remove the paper wrapper from 1 side only of the 2-piece wrapper on the gasket. The outside paper will protect the gasket and assure against stretching.
  - 3. Before setting the manhole section in the trench, attach the plastic gasket strips end-to-end to the tongue or groove of each joint, forming a continuous gasket around the entire circumference of the manhole joint.
  - 4. - Handling of barrel sections after the plastic gasket has been affixed shall be carefully controlled to avoid bumping the gasket and thus displacing it or covering it with dirt or other foreign material. Remove any gaskets so disturbed; replace if damaged and reposition if displaced.
  - 5. Properly align the manhole section with the previously set section before it is lowered into position.
  - 6. During cold or wet weather:
    - a. Pass direct heat over the concrete joint surface lightly until ice, frost, and moisture are removed and surface to be primed is dry and warm immediately before application of primer.
    - b. Pass direct heat over plastic gasket strips immediately prior to attaching them to joint surfaces and immediately prior to insertion of tongue into groove.
- H. Manhole Surface Block:
  - 1. Pour blocks for precast manholes against native, undisturbed earth or compacted structural backfill material which has been excavated to the dimensions shown on Drawings.
  - 2. If over-excavation occurs beyond the horizontal or vertical dimensions shown on Drawings, construct forms to the specified dimensions prior to placement of concrete for the surface block.

### 3.6 MANHOLES

- A. Precast sections of manholes shall be assembled accurately with full bed mortar or preformed flexible plastic sealant joints.
  - 1. Bring tops of manholes accurately to the elevations indicated on the Drawings, or if no elevation is indicated, bring tops flush with the surface of the surrounding ground or pavement.
  - 2. Provide smooth concrete surfaces of box culverts, headwalls, and other

- structures in contact with flowing water, so as to reduce friction losses as much as possible.
  - 3. Remove all fins and projections.
  - 4. Fill form tie holes, honeycomb areas, and other voids and irregularities with a stiff cement grout and trowel flush with adjoining surfaces.
- B. Manhole Channels - Where sewer lines pass through manholes, pipe shall be used as a form for the channel.
  - 1. After the manhole base concrete has taken a set, carefully shape and mortar the channel to a smooth surface.
  - 2. Check channels with the proper template.
- C. Manhole Throat - The maximum depth of the manhole throat shall be 18 inches, measured from the top of the manhole cover to the lower extremity of the throat at the top of the cone section.
  - 1. Construct the throat by use of appropriately sized reinforced concrete grade rings that will bring the manhole cover to finished grade surface.
  - 2. Do not use plastic sealing gaskets for jointing grade or extension rings in place.
- D. Manhole Construction:
  - 1. Excavate, install and backfill manholes in conformance with the requirements of these Specifications.
  - 2. Compact embedment Materials under, around, and at least 3 inches over all pipelines located within 5 feet of structure bases without jetting.
  - 3. Construct manholes to subgrade prior to backfilling adjoining sewer pipeline trench and/or structure backfill where such method of compaction is permitted and used.
- E. Provide structures constructed with precast sections of a single manufacturer and/or with such compatible products as recommended by the precast manufacturer.

### 3.7 FINAL ACCEPTANCE OF STORM DRAINS

- A. Pipelines shall be video surveyed per SFPUC Video Survey Requirements for Sewer Asset, Effective January 2014. Contact SFPUC Sewer Operations, [aliu@sfwater.org](mailto:aliu@sfwater.org), 415-641-2372 for full requirements.
- B. Prior to backfilling the storm drainage, combined sewer or sanitary sewer pipes, the contractor shall perform low pressure testing in accordance with the ASTM standard testing specification. Testing shall be performed in the presence of the City's representative and to the satisfaction of the City's representative prior to backfilling.
- C. Final acceptance of storm drains intended for public use will be contingent upon an interior television inspection provided at the expense of the contractor.

Groundwater infiltration shall not exceed 170 gallons per day per acre (gpd/acre).

- D. Upon completion of the project, the contractor shall provide the City with a reproducible copy and, if requested, microfilms or diskettes of the final record drawings. Microfilms shall be in accordance with the format utilized by the City. The films shall be delivered to the City for a permanent record.
- E. All new manholes shall be vacuum tested to current ASTM standards.

END OF SECTION

SECTION 02730  
SANITARY SEWER SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

- A. Sewer collection system includes, but is not limited to, the following:
  - 1. Sanitary sewer lines.
  - 2. Manholes, frames and covers.
  - 3. Connection to Existing System.
  - 4. Sanitary sewer service connections.

1.2 RELATED SECTIONS

- A. Section 02225, "Excavation, Backfilling and Compacting for Utilities."

1.3 REFERENCES

- A. Subdivision Regulations, adopted by the Department of Public Works (DPW) Resolution No. 124,677, Bureau of Engineering (BOE), DPW, City and County of San Francisco, January 6, 1982.
- B. Standard Specifications, DPW, BOE, revised November 2000.
- C. Standard Plans, BOE, DPW, revised April 2007.
- D. City and County of San Francisco Plumbing Code
- E. Department of Public Works (DPW) Order No. 171,442 "Regulations for Excavations and Restoring Streets in San Francisco," approved January 1; 1999.

PART 2 — PRODUCTS

2.1 GENERAL

- A. Structures, pipes, fittings, and materials shall be per requirements of Part 3, "Sewerage and Drainage," of the City Standard Specifications; and City Standard Plans, except as modified herein.

2.2 SANITARY SEWER MAINS

- A. Sewers eight inches (8") to twelve inches (12") in diameter shall be vitrified clay

pipe (VCP) (ASTM C-700 Extra Strength).

- B. Joints - VCP sewers shall have bell and spigot joints with factory fabricated compression type fittings (ASTM C-425).
- C. General: Furnish ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the Engineer.
- D. Provide pipe, pipe joints incorporated into the pipe, and manufactured fittings connecting pipe between structures of only one manufacturer and of the same type, quality, class and size unless otherwise specified or detailed on the Drawings.
- E. Pipe sizes refer to the nominal inside diameter of pipe (including any pipe linings); pipe more than 1/4 inch smaller than the nominal size designated will not be accepted, except where specified herein.

## 2.3 MANHOLES

- A. Manholes shall be constructed in accordance with Standard Plans and Standard Specifications.
- B. Manholes built in reference to SFDPWSP # 87 and 181 shall negate sheet note #7 and install rebar as shown.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Installation of sewers and structures shall conform to requirements of Part 3, "Sewerage and Drainage," of the City Standard Specifications.
- B. Installation of side sewer connection' shall be per section 316 of City Standard Specifications and Standard Plan Drawings 44,337 and 44,851.

### 3.2 SANITARY SEWER MAINS

- A. Location - As shown on plans.
- B. Depth and Cover - The minimum depth of sewers shall be as shown on drawings.

- C. Bedding shall be crushed rock per requirements of Section 305.07 of the City Standard Specifications.
- D. Settlement - Pipelines shall be designed to comply with the construction documents at the time of construction and after 100% of the predicted fifty- (50-) year settlement.
- E. Lay sewer pipe with a minimum 12 inches vertical clearance from all other improvements and utilities, unless otherwise approved.
- F. Lay pipe to conform to the prescribed line and grade as shown on Drawings and check each pipe length to the grade line established from the grade stakes.
  - 1. This grade line shall be established before any pipe is laid in the trench.
  - 2. For pipes with slopes greater than 1 percent, the string line set for trenching purposes may be used as the grade line.
  - 3. For pipes with slopes less than 1 percent, either:
    - a. A grade line shall be established in the bottom of the trench such that the top of each bell will touch the line when the pipe has been properly positioned or,
    - b. A grade line shall be established above the trench on firmly secured batter boards from which the grade of each pipe can be checked by using a grade pole.
- G. Alternate use of commercial LASER grade setting systems in lieu of string lines specified herein are acceptable when the following requirements and conditions are met:
  - 1. Provide an instrument operator who is qualified and trained in the operation of the LASER; adhere to the provisions of the state of California Construction Safety Orders issued by the Division of Industrial Safety, particularly Sections 1516, and 18900 through 1801.
  - 2. Use established bench marks or construction off-set stakes identified on cut sheets and set in the field for the work, LASER set up points shall be on these control points or on points set directly from them by instrument.
- H. Lay each length of pipe on compacted, approved bedding material with full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all bell and spigot joints.
  - 1. 'Stabbing', 'Swinging In' or 'Popping On' spigot ends of pipe into bell ends will not be permitted.
  - 2. After jointing is accomplished, all annular spaces between pipe and bell holes shall be packed with bedding material, taking care not to damage,

move, or lift the pipe from its bedding support.

- I. Plug or cap sewer pipes, branches, stubs, or other open ends which are not to be immediately connected with a standard watertight plug or cap.
  - 1. Place the plug or cap on a standard end.
  - 2. Plug open pipe ends on which rodding inlets, etc., are to be constructed with an approved mechanical expanding plug until the structure is completed and the cover is in place.
- J. Short radius curves conforming 80 percent of the maximum deflection limitation set forth by the manufacturer may be supplied and installed in minimum 2 foot pipe lengths
- K. Make 'adjustments of pipe to line and grade by scraping away or filling in and tamping approved material under the body of the pipe. No wedging or blocking to support the pipe will be permitted.
- L. Lay sewer line, gravity or pressure upgrade from point of connection to existing sewer and with the bell end forward or upgrade unless otherwise approved.
  - 1. Do not lay pipe when the condition of the trench or the weather is unsuitable.
  - 2. When pipe laying is not in progress, the forward end of the pipe shall be kept closed with an approved temporary plug or cap.
- M. Flexibility of joints in or at the manhole base shall be preserved to prevent damage to the pipe by differential settlement. See City Standard Specification 305.03.
- N. Install vitrified clay pipe entering and leaving manholes or other structures with joints as follows:
  - 1. Pipe 6, 8, and 10 inches in diameter shall have 2 approved joints within 3'-3" of the manhole base.
  - 2. One joint shall be incorporated in the manhole base or installed immediately adjacent to the manhole base and there shall not be less than 12 inches between the 2 joints.

### 3.3 SEWER CONNECTIONS

- A. Y branches of vitrified clay shall be installed on all VCP sewers in locations described under the "Side Sewers" section of these Regulations. They shall be six inches (6") in diameter.

### 3.4 MANHOLES

- A. Precast sections of manholes shall be assembled accurately with full bed mortar or



preformed flexible plastic sealant joints.

1. Bring tops of manholes accurately to the elevations indicated on the Drawings, or if no elevation is indicated, bring tops flush with the surface of the surrounding ground or pavement.
  2. Provide smooth concrete surfaces of box culverts, headwalls, and other structures in contact with flowing water, so as to reduce friction losses as much as possible.
  3. Remove all fins and projections.
  4. Fill form tie holes, honeycomb areas, and other voids and irregularities with a stiff cement grout and trowel flush with adjoining surfaces.
- B. Manhole Channels - Where sewer lines pass through manholes, pipe shall be used as a form for the channel.
1. After the manhole base concrete has taken a set, carefully shape and mortar the channel to a smooth surface.
  2. Check channels with the proper template.
- C. Manhole Throat - The maximum depth of the manhole throat shall be 18 inches, measured from the top of the manhole cover to the lower extremity of the throat at the top of the cone section.
1. Construct the throat by use of appropriately sized reinforced concrete grade rings that will bring the manhole cover to finished grade surface.
  2. Do not use plastic sealing gaskets for jointing grade or extension rings in place,,
- D. Manhole Construction:
1. Excavate, install and backfill manholes in conformance with the requirements of these Specifications.
  2. Compact embedment materials under, around, and at least 3 inches over all pipelines located within 5 feet of structure bases without jetting.
  3. Construct manholes to subgrade prior to backfilling adjoining sewer pipeline trench and/or structure backfill where such method of compaction is permitted and used.
- E. Provide structures constructed with precast sections of a single manufacturer and/or with such compatible products as recommended by the precast manufacturer:

### 3.5 RECONSTRUCTION OF EXISTING STRUCTURES

- A. General - Before beginning any structure reconstruction work, submit in

writing, a summary of the procedures, which shall conform to the criteria listed below. Approval of this work summarization, shall be authorization to proceed.

1. When removing existing structures located on live systems:
  - a. Ensure that no foreign material enters into the existing sewer lines.
  - b. Prevent pieces of concrete mortar, brick, wood, etc. from entering into the live lines.
2. All workmanship and materials for structure adjustments shall conform to the requirements of these Specifications.
3. In the case of existing brick or cast-in-place concrete structures; accomplish repair or adjustments with materials in kind or with precast elements as detailed on the Drawings and/or approved.

B. Manholes

1. Before any work is started on adjusting or repairing manhole, cover the channels in the base with plywood or a similar material and then the entire base covered with a heavy piece of canvas temporary debris cover.
  - a. Keep temporary debris cover in place during all work, and upon completion, picked up containing all debris.
  - b. Remove the canvas and plywood from the manhole allowing no debris to fall or to remain in the manhole.
2. Accomplish manhole adjustments by one of the methods specified herein or as detailed on the Drawings.
3. Make upward adjustments of standard manholes to finish grade surface using reinforced concrete grade rings or formed concrete (Case II) and/or a cast iron extension ring (Case I) when the completed manhole throat does not exceed a total of 18 inches.
  - a. Single concrete grade rings may be used for such adjustments not exceeding 4 inches.
  - b. In no case shall multiple cast iron extension rings be used in adjustments.
4. In upward adjustments of standard manholes which would create a completed manhole throat section exceeding 18 inches, remove the upper manhole section, including reinforced concrete block and cone section, and make the adjustment by use of additional manhole barrel sections, cone, grade rings, etc. (Case III).
5. To make downward adjustments of standard manholes (Case III) remove existing grade or extension rings.
  - a. When specifically approved, carefully chip the top of the existing precast cone section away such that the inside diameter of said cone at the top does not exceed 27 inches.
  - b. When chipping the cone is so approved, the chipped portion of the cone shall be mortared to a smooth, level surface with Class I mortar and allowed to dry prior to replacement of the frame and cover.
  - c. No downward adjustment by chipping will be permitted if the

- frame and cover casting is the standard weight variety.
- d. When such removals and/or chipping will not accomplish the necessary adjustment, remove the upper manhole section, including barrel sections as required, and reconstruct the manhole as specified above.
  - e. In all downward adjustments the dimensional requirements of the reinforced concrete block in the upper section of the manhole shall be maintained or restored.

### 3.6 EXISTING SEWERS

- A. Existing sewers are indicated on the Drawings at locations where new sewers are to be connected. Determine the exact location and depth of the existing sewers prior to the installation of any sewer pipe.
- B. Where the connection is to be made into an existing manhole, make the connection by breaking through the manhole base, cutting a rough channel through the manhole shelf to the existing channel, installing the new pipe finishing a new channel within the manhole and repairing any damage to the-structure.
- C. Where the connection is to be made by constructing a new manhole over an existing sewer, the existing sewer shall not be broken until immediately before the cleaning and flushing operation commences.
- D. Leave sewer line connections to manholes, trunk sewers, or side sewers uncovered until after the inspection has been made. After approval of the connection, backfill the trench as specified.

### 3.7 FINAL ACCEPTANCE OF SEWERS AND STORM DRAINS

- A. Pipelines shall be video surveyed per SFPUC Video Survey Requirements for Sewer Asset, Effective January 2014. Contact SFPUC Sewer Operations, [aliu@sfwater.org](mailto:aliu@sfwater.org), 415-641-2372 for full requirements.
- B. Prior to backfilling the storm drainage, combined sewer or sanitary sewer pipes, the contractor shall perform low pressure testing in accordance with the ASTM standard testing specifications. Testing shall be performed in the presence of the City's representative and to the satisfaction of the City's representative prior to backfilling.
- C. Final acceptance of sewers and storm drains intended for public use is contingent upon an interior television inspection provided at the -expense of the contractor. Groundwater infiltration shall not exceed 170 gallons per day per acre (gpd/acre).
- D. Upon completion of the project, the contractor shall provide the City with a

reproducible copy and, if requested, microfilms or diskettes of the final record drawings. Microfilms shall be in accordance with the format utilized by the City. The films shall be delivered to the City for a permanent record.

- E. All new manholes shall be vacuum tested to current ASTM standards.

END OF SECTION

SECTION 02780  
STONE COBBLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Perform all paving work and related items as indicated on the Drawings and/or as specified herein including, but not limited to the following.
  - 1. Cobble Stone paving at lawn edge.
  - 2. Paver Edge.
- B. Products Installed But Not Furnished Under This Section:
  - 1. Permeable Aggregate Base
- C. Related Sections:
  - 1. Cast-in-Place Concrete – Section 03300
  - 2. Permeable Aggregate Base – Section 02231

1.2 DEFINITIONS

- A. The following related items are included herein and shall mean:
  - 1. ASTM: American Society for Testing and Materials
  - 2. AASHTO: American Association of State Highway and Transportation Officials.
  - 3. NBGQA Standards: Recommended Standards of the National Building Stone Quarries Associations, Inc.

1.3 REFERENCES

- A. American Society of Testing and Materials:
  - 1. ASTM C241 Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
  - 2. ASTM C1242 Guide for Design, Selection, and Installation of Exterior Dimension Stone Anchors and Anchoring Systems

#### 1.4 QUALITY ASSURANCE

- A. Subcontract fabrication and installation of cut stone work to a firm or firms which have successfully fabricated work of a similar quality and schedule requirements, and in the quantity shown, for a period of not less than 3 years.
- B. Coordination of Fabrication:
  - 1. Refer to the Submittals regarding the submission of coordinated shop drawings.
  - 2. Wherever necessary, field check and confirm dimensions shown on Contract Drawings at the site by using surveying equipment as necessary or accurate field measurements before final submittal of shop drawings and before final fabrication of stone work. Coordinate installation tolerances to insure proper fit of final stone work.
- C. Installer must review installation procedures and sequence with Construction Manager to insure proper coordination with other subcontractors and suppliers whose work is affected by the delivery schedule and installation of stone work.
- D. Construction Tolerances for Stone Work: This will apply to exposed surfaces of the work that is installed.
  - 1. Variation from Level: For grades shown and other conspicuous lines, do not exceed 1/8" for individual grades or 3/8" in 10' for level line. Refer to Drawings.
- E. First Install: First installation shall be completed to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
  - 1. First installation shall be completed for each type of rock setting and placement as indicated.
  - 2. The extent and location of first installations shall be as shown in the drawings.
  - 3. First installations shall be protected and incorporated in the completed work.
  - 4. Approval of first installation is for placement, texture, and overall shaping of rock surface.

#### 1.5 MOCK-UP

- A. Cobble Paver layout mock up
  - 1. Construct mock up panel to include cobble paving and paving edge. Construct at least one month before start of Stone work.

2. The Mock up area will be used to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s), and texture of the job. This area shall be the standard from which the work will be judged.
3. Preserve mock- up until after the actual work has been accepted.
4. The quality of workmanship, joint treatment, and cleanliness of stone after installation must be approved by Owner's Representative before permanent paving is started. If the original sample is not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved sample shall become the standard for paving for the entire job. Panel may be constructed on a location becoming part of the final pavement and shall remain undisturbed until all paving is completed unless authorized otherwise by Owners Representative.

#### 1.6 SUBMITTALS

##### A. Shop Drawings

1. Provide shop drawings for special details.
2. Clearly indicate adjacent work, provided by other trades.
3. Submit procedures for the repair and/or replacement of stones before and after installation.

##### B. Samples

1. Stone: Submit full size samples sets of cobble stone pavers to indicate color and finish selections. Provide the number and size necessary to show full range of color, texture, finish, and kind and distribution of characteristic markings. Minimum submission: Two sets of three 3 ½" x 3 ½" X 3 ½" cobble stone. Each set shall show extremes and middle of the range of appearance variations of stone proposed for the project.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cobble stone pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.
- B. Sand shall be covered with waterproof covering to prevent exposure to rainfall or removal by wind. The covering shall be secured in place.
- C. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
- D. Do not install stone when soil conditions are wet.

## 1.8 REPAIR AND REPLACEMENT

- A. The intent of this Section is to provide for the repair of defects in stone in such a way as to produce a structurally sound and aesthetically pleasing stone regardless of whether the defects are naturally existing in the stone or were produced or exacerbated during quarrying, fabrication, handling, or erection.
- B. Repair and replacement procedures must be approved in writing by the Owner's Representative before being used.
- C. At job site on arrival: Defects may be repaired, provided that the repaired material neither impairs the structural integrity nor degrades the aesthetic qualities of the stone. Repairable defects include cracks less than 0.010" in width and less than 1/2 the stone width, whichever is smaller. Stones with scratched or abraded surfaces or with breaks extending from edge to edge shall be replaced.

## 1.9 GUARANTEE

- A. All workmanship and materials shall be guaranteed for a period of not less than one year from the date of acceptance.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. General Requirements
  - 1. Stone shall be sound stock of uniform texture; free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects that impair strength or durability or appearance. It shall have required mechanical and physical properties. Appearance shall be within the range illustrated by each set of accepted samples.
  - 2. Stone shall be from a single quarry.
  - 3. No substitutions accepted for color, finish and dimensions. Depending on availability of specified stone, Landscape Architect will review possible substitution of equal material.
- B. Stone
  - 1. Cobble Stone Paving
    - a. Color / Product: 'Academy Black' Granite
    - b. Finish: Flamed
    - c. Size: 3 1/2" X 3 1/2" X 3 1/2"
    - d. Joint Size: See drawings
    - e. Distributor: Cold Spring Granite Corp., 1977 Sage Ave., Corona, CA, Tel. 951.549.9042 or American Soil & Stone (510) 292-3007



- C. Paver Edge: Use at cobble stone paving edges. Industrial Pave Edge manufactured by. Pave Tech. 10 ft. long, straight one- piece section, with predrilled holes 6" apart alternating backside front extension lip. Place PAVE EDGE on top of uniformly compacted base per detail. Spike through edging into compacted base with 10" x 3/8" dia. steel spikes, every 6" into pre-drilled holes. Pave Tech (800) 728- 3832, Pavetech.com, or approved equal.

## 2.2 BEDDING AND JOINT SAND

- A. Bedding and joint sand shall be clean, non-plastic, free from deleterious or foreign matter. The sand shall be natural or manufactured from crushed rock. Limestone screenings or stone dust shall not be used. When concrete pavers are subject to vehicular traffic, the sands shall be as hard as practically available.

- B. Grading of sand samples for the bedding course and joints shall be done according to ASTM C136. The bedding sand shall conform to the grading requirements of ASTM C 33 as shown in Table 1.

Table 1: Grading Requirements for Bedding Sand

| ASTM C 33        |                 |
|------------------|-----------------|
| Sieve Size       | Percent Passing |
| 3/8 in. (9.5 mm) | 100             |
| No. 4 (4.75 mm)  | 95 to 100       |
| No. 8 (2.36 mm)  | 85 to 100       |
| No. 16 (1.18 mm) | 50 to 85        |
| No. 30 (600 µm)  | 25 to 60        |
| No. 50 (300 µm)  | 10 to 30        |
| No. 100 (150 µm) | 2 to 10         |

- C. The joint sand shall conform to the grading requirements of ASTM C 144 as shown in Table 2 below:

Table 2: Grading for Joint Sand

| ASTM C 144       |                              |
|------------------|------------------------------|
| Sieve Size       | Natural Sand Percent Passing |
| No. 4 (4.75 mm)  | 100                          |
| No. 8 (2.36 mm)  | 95 to 100                    |
| No. 16 (1.18 mm) | 70 to 100                    |
| No. 30 (600 µm)  | 40 to 75                     |
| No. 50 (300 µm)  | 10 to 35                     |
| No. 100 (150 µm) | 2 to 15                      |
| No. 200 (75 µm)  | 0                            |

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Preparation

1. Installer must review installation procedures and sequence with General Contractor to insure proper coordination with other subcontractors and

suppliers whose work is affected by the delivery schedule and installation of stone work.

2. Protect stone during storage and construction against moisture, soiling, staining, and physical damage.
3. Before commencing work, thoroughly clean surfaces to be covered with stone of all dust, dirt, and foreign matter.
4. Verify that base is dry, uniform, even, and ready to support sand, pavers, and imposed loads.
5. Beginning of bedding sand and paver installation means acceptance of subgrade and base preparation.
6. Contractor shall examine the concrete base to determine its adequacy to receive stone bench and curbs. Evidence of inadequate base shall be brought to the immediate attention of the Owner's Representative.

B. Repair and Cleaning

1. Remove and replace stone units which are broken, chipped, stained, or otherwise damaged. Where directed, remove and replace units which do not match adjoining stonework. Provide new matching units, install as specified, and point-up joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints to provide a neat, uniform appearance.
2. All stone masonry work shall be cleaned thoroughly to remove stains, excess mortar, sealant, dirt and other discoloration, or blemishes.
3. Cleaning operations shall commence following a minimum twenty-eight day curing period for the masonry construction.
4. Follow manufacturer's instructions for the use, handling, and application of masonry cleaners.

C. Protection

1. Contractor shall implement all necessary procedures required to protect completed stonework from damage prior to final acceptance.

3.2 COBBLE STONE PAVING

- A. Spread the sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1-1/2 in. (40 mm) thickness. The screeded sand should not be disturbed. Place sufficient sand to stay ahead of the laid pavers. Do not use the bedding sand to fill depressions in the base surface.
- B. Ensure that pavers are free of foreign materials before installation.

- C. Lay the pavers in a running bond with long joints parallel to adjacent concrete paving. Maintain straight joint pattern lines parallel to adjacent concrete paving. Stagger running bond cross joints perpendicular to adjacent concrete paving.
- D. Joints: Joints between the pavers on average shall be between 1/8 in. and 3/8 in. wide.
- E. Use a low amplitude, high frequency plate vibrator to vibrate the pavers into the sand. Minimum Centrifugal force shall be 5000 lbs. (22kN)
- F. Vibrate the pavers, sweeping dry joint sand into the joints and vibrating until they are full. This will require at least two or three passes with the vibrator. Do not vibrate within 3 ft. of the unrestrained edges of the paving units.
- G. All work to within 3 ft. of the laying face must be left fully compacted with sand-filled joints at the completion of each day.
- H. Sweep off excess sand when the job is complete.
- I. The final surface elevations shall not deviate more than 3/8 in. (10 mm) under a 10 ft. (3 m) long straightedge.
- J. The finish surface elevation of pavers shall be flush with adjacent concrete paving or as shown on the Drawings.
- K. The resanding as necessary of paver joints shall be accomplished by contractor for a period of 90 days after completion of work.

END OF SECTION

SECTION 02810  
IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 PROVISIONS

- A. The General Requirements and Special Provisions shall apply to the work of this section as fully as if they were repeated herein.

1.02 DESCRIPTION

B. Work Included:

1. Order and furnish all labor, materials, supplies, tools and transportation and perform all operations in connection with and reasonably incidental to the complete installation of the automatic sprinkler irrigation system as shown on the Drawings. The work includes, but is not limited to:
  - a. Verification of sizes, locations, proper quantities, and proper operation of water and electrical service points of connection as indicated on the drawings.
  - b. Verification of sizes and access of existing sleeving and conduit as indicated on the drawings.
  - c. Automatic irrigation system including piping, fittings, sprinkler heads, bubblers, emitters, dripline, and accessories.
  - d. Valves.
  - e. Control wiring.
  - f. Testing.
  - g. Excavation and backfilling irrigation system work.
  - h. Record Drawings.
  - i. One year guarantee plus manufacturers warranties.

C. Related Work:

1. Grading.
2. Landscape Planting.

1.03 GENERAL REQUIREMENTS

- A. OSHA Compliance: All articles and services covered by this Specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this Specification.
- B. Codes and Standards: Comply with all applicable codes and standards.

1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, published by the Western Plumbing Officials Association; and other applicable State or local laws or regulations. Nothing in the Drawings or Specifications is to be construed to permit work not conforming to these codes.
2. When the Specifications call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations.
3. Furnish, without any additional cost to the Engineer, any additional material and labor required to comply with these rules and regulations. Provide the work even if it is not mentioned in this section, or shown on the Drawings, in order to comply with all applicable codes.
4. Erect and maintain barricades, guards, warning signs, and lights as required by the owner or required by OSHA regulations for the protection of the public or workmen. All lane closures shall be in accordance with CalTrans traffic control.
5. Repair or replace at no additional cost to the Owner, any damage to existing utilities, buildings, equipment, irrigation, piping, pipe covering, sewers, sidewalks, paving surfaces, structures, or landscaping, caused by work of this section. Repair or replace in a manner satisfactory to the Owner.

#### 1.04 QUALITY ASSURANCE

- A. Provide evidence to the Owner that skilled and experienced supervisor and work crew will be employed on the job from beginning to end. The supervisor shall be English speaking and shall have full authority to act on behalf of the Contractor.

#### 1.05 LAYOUT OF WORK

- A. Stake out the irrigation system as shown on the approved drawings. Obtain approval from the Owner's representative before starting work. Such approval does not relieve the contractor of the responsibility to comply with the plans and specifications.
- B. For purposes of clarity and legibility, drawings are diagrammatic to the extent that many offsets, bends, unions, special fittings, and exact locations of items are not indicated, unless specifically dimensioned. Wherever possible, install piping in planting areas. Drawings may show piping under paving for clarity.
- C. Exact routing of piping, etc., shall be governed by structural conditions, obstructions, utilities, and location of burial plots.
- D. Do not willfully install the irrigation system as shown on the drawings when it is obvious in the field that unknown obstructions, grade difference or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences shall be brought to the attention of the Owner's representative. In the event this notification is not performed, the contractor shall assume full responsibility for any revision necessary.

## 1.06 SUBMITTALS

### A. Submittals:

1. Within 15 working days after contract is signed, submit six copies of catalogue information on materials that are to be used.
2. No substitution will be permitted without prior written approval by the Owner's representative.
3. Complete material list shall be submitted and approved prior to performing any work.

### B. Record Drawings:

1. Maintain in the field one complete set of blackline prints of the contract drawings for the irrigation system. Show all water lines, sleeves, conduit, wire routing, sprinklers, valves, controllers, and stub-outs. If work is not installed as indicated on the record drawings such work shall be corrected at no additional cost to the Owner.
2. The Owner's representative may call for the record drawings at any time. If the record drawings are not current, progress on the job will stop until the record drawings are brought up-to-date.
3. Locate and dimension all underground stub-outs for future connections and valves. Locate and dimension accurately from two permanent features on all record drawings. Provide dimensions at 100' maximum intervals along mainline and wire routing.
4. Submit the record working prints to the Owner's representative for approval.
5. Provide documented actual flow rates at the time of as-built submittals. Actual precipitation, cycle and soak rates are to be provided by the contractor after installation.

### C. Operation and Maintenance Manuals:

1. Prior to the final inspection of the irrigation system, furnish two (2) individually bound Service Manuals to the Owner's representative. The manuals shall contain the following:
  - a. Index sheet indicating the contractor's name, address, and phone number.
  - b. A copy of the completed guarantee-following the form in these specifications.
  - c. Certificate of insurance verifying coverage for completed operations.
  - d. List of equipment with names, addresses and telephone numbers of all local manufacturers representatives.
  - e. Copies of equipment warranties and certificates.
  - f. Complete operating and maintenance instructions of all equipment including exploded drawings and spare parts list.
  - g. Provide instruction in operation of system to Owner's personnel.

### D. Hardware Items: Contractor shall provide the following:

1. Two (2) sets of matching quick coupling valve keys and hose swivels.

2. Two (2) keys to each controller box.
3. Two (2) sets of any special tool required for the maintenance of each type of component used in the sprinkler system.

#### 1.07 CONTROLLER CHARTS

- A. Obtain Owner's representative approval of the Record Drawings before charts are prepared.
- B. Provide two charts for each controller installed, showing the area covered by the controller. The charts are to be as follows:
  1. 8 1/2 by 11 inch.
  2. Easily readable reduced drawing of the installed system.
  3. Black line print with a light color-highlighting marker used to show area of coverage for each station. Use a different color for each station.
  4. Hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils. thick.
- C. Complete the chart and obtain approval from the Owner's representative prior to final inspection of the irrigation system.

### PART 2 - PRODUCTS

#### 2.1 PIPE AND FITTINGS

- A. PVC Pipe and Fittings:
  1. Main lines (constant pressure) 2½" and smaller shall be polyvinylchloride (PVC) 1120 - Schedule 40 with solvent weld socket connections. Use Schedule 40, Type I, Grade I, PVC solvent weld fittings.
- B. Lateral lines (non-pressure) and sleeves shall be 1120 – Schedule 40 PVC plastic pipe with Schedule 40, Type I, Grade I, PVC solvent weld fittings.
- C. Connections between main lines and RCV's shall be made with Schedule 80 PVC (threaded both ends) nipples and fittings.
- D. Sprinkler risers shall be as follows: Schedule 80 PVC threaded nipples and elbows as shown in the construction details.

#### 2.2 QUICK COUPLER VALVES

- A. Quick coupler valves shall be Rain Bird 33DNP, two piece, lockable rubber cover, non-potable water warning or approved equal.

## 2.3 IRRIGATION CONTROLLER

- A. Controller shall be as listed on the Drawings

## 2.4 MASTER AND REMOTE CONTROL VALVES

- B. Master control valve: normally open. Valves shall be Griswold, globe pattern with cast iron body and bonnet; brass flow stem and manual bleed petcock. Sizes of valves shall be as listed on the Drawings.
- C. Remote control valve: normally closed. Valves shall be Toro P220 series, globe pattern with plastic body and bonnet, plastic flow stem and manual bleed petcock. Sizes of valves shall be as listed on the Drawings.

## 2.5 EMITTER CONTROL VALVES

- A. Emitter control valve: normally closed. Valves shall be a globe pattern with plastic body and bonnet, plastic flow stem and manual bleed petcock. Valve assembly shall include a Toro regulator and emitter filter. Sizes of valves shall be as listed on the Drawings.
- B. Control zone kits shall be Toro control zone kits as indicated on construction drawings.

## 2.6 FLOW SENSOR

- A. Flow sensor shall be Rain Master (Data Industrial) as listed on the drawings.

## 2.7 LOW VOLTAGE COMMUNICATION CABLE

- A. Control wire shall be copper with U.L. approval for direct burial in ground, size #14. Common ground wire shall have white insulating jacket, size #12. Control wire shall have insulating jacket of color other than white. Splices shall be made with 3M-DBY seal packs. Provide a separate ground wire for each controller.

## 2.8 FLOW SENSOR CABLE

- A. Toro low voltage communication cable.

## 2.9 VALVE BOXES

- A. For master and remote control valves, pull boxes or flow sensor, use a Carson Model 1419 plastic valve box or equal with bolt-down plastic lid. Lid shall be marked: "Irrigation".
- B. For gate valves and quick coupling valves use Carson Model 910 10-inch diameter round plastic valve box with bolt-down plastic lid. Add extensions for gate valves as required.



## 2.10 SPRINKLER HEADS AND BUBBLERS

- A. Pop-up spray sprinkler heads with a built-in check valve shall be as specified on the drawings.

## 2.11 GATE VALVES

- A. Gate valves shall be as listed on the drawings

## 2.12 MISCELLANEOUS EQUIPMENT

- A. Provide all equipment called for by the Drawings.

## 2.13 BACKFLOW PREVENTION DEVICE

- A. Backflow prevention device shall be the reduced pressure type with gate valves, check valves, test cocks, reduced pressure chamber and air vents. Install 12" above finish grade.
- B. Backflow enclosure shall be sized to fit specified backflow prevention device and be constructed of stainless steel and be hinged for ease of access. Manufacturer to be Guard Shack or approved equal.

## 2.14 MISCELLANEOUS INSTALLATION MATERIALS

- A. Solvent cement and primer for solvent weld joints: provide make and type approved by manufacturer(s) of pipe and fittings. Cement shall be maintained at proper consistency throughout use.
- B. Pipe joint compound: non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Teflon paste, Rectorseal T+2 pipe thread sealant, or equal.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install irrigation system in accordance with all applicable local and state codes and ordinances by a licensed landscape contractor.
- B. Follow manufacturer's direction except as shown or specified.

### 3.2 INSPECTION OF SITE CONDITIONS

- A. All scaled dimensions are approximate. The contractor shall check and verify all size dimensions prior to proceeding with work.

- B. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, and groundcover.
- C. Avoid trenching within drip line of trees where possible. When not possible, all damaged roots over 1 1/2" in diameter shall be cut leaving clean face, seal cuts with tree seal, then immediately install pipe, wire, etc., refill trench and soak.
- D. The contractor shall carefully check all grades to determine that the work may safely proceed before starting the irrigation installation.
- E. Coordinate work with work of others for the location of pipe and/or conduit to avoid conflicts with lighting, utilities, etc.
- F. Verify existing point of connection or water meter, water pressure and available gallonage prior to construction. If deficiencies are noted that will hinder the system's performance, notify the Owner's representative for directions to correct deficiencies.
- G. The design is diagrammatic. Drawing may show piping, conduit, valves, etc., within paved areas. This is for design clarity only. Install piping, conduit, valves, etc., in planting areas wherever possible. All piping and low voltage wire installed beneath paved areas or hardscape shall be contained within sleeving or conduit.

### 3.3 PROJECT COORDINATION

- A. Sequencing and Scheduling: Coordinate irrigation installation work with the installation of other site improvements, including utility installation work and landscape installation.
- B. Environmental Conditions: Site work such as trenching and backfilling shall not be performed during wet, muddy or frozen conditions.

### 3.4 PROTECTION OF WORK AND MATERIALS

- A. Contractor shall protect all work in the contract and the work of others for the duration of the contract. Protect plastic pipes and fittings from direct sunlight, and avoid undue bending and any concentrated external loading. Beds on which pipe is stored shall be full length of pipe. Pipe or fittings that have been damaged shall not be used.
- B. Contractor shall exercise extreme care in excavating, boring, and working near existing utilities. Damage to utilities that are caused by contractor's operation shall be the Contractor's responsibility to repair or replace at no additional cost to the Owner. Call Underground Services Alert (USA) at 800-642-2444 for underground marking.
- C. Take the necessary precautions to protect site conditions and plant material that is to remain. If damage is incurred, repair damage to its original condition or furnish and install equal replacements at no additional cost to the Owner.

### 3.5 CORRECTION OF WORK

- A. Correct any and all discrepancies or unsatisfactory work at no additional expense to the Owner. Provide correction of work within a reasonable period mutually agreed upon between the Owner's representative and the Contractor.

### 3.6 PREPARATION - LAYOUT OF WORK

- A. Prior to installation, stake out all pressure supply lines, and wire routing and locations of sprinkler heads and control valves and notify Owner's representative to review layout.

### 3.7 INSTALLATION

#### A. Trenching:

1. Dig trench straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout shown on drawings.
2. Provide for a minimum of 18" cover for 2½" and smaller pressure supply lines and conduit for communication cable or low voltage wiring.
3. Provide for a minimum cover of 12" for all non-pressure lines to spray heads and bubblers.
4. Provide for a minimum cover of 18" for all direct-bury low voltage control wiring.

#### B. Backfilling:

1. Do not backfill trenches until all required tests are performed. Carefully backfill trenches with approved excavated materials for backfilling, consisting of earth, loam, sandy clay, sand, or other acceptable materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

#### C. Pipe and Fitting Installation and Connections:

1. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
2. Install all assemblies specified herein in accordance with details shown.
3. Thoroughly clean PVC pipe and fittings of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
4. Pipe is to be a minimum of 4-inches from walkways, fences, curbs, etc. and 8-inches from buildings and other permanent structures.

#### D. Sleeves and Conduit:

1. Install low voltage wiring in conduit under pavement along same routing as

mainline pipe wherever possible.

2. Provide removable non-decaying plug at ends of sleeves and conduits to prevent entrance of earth.
3. Sleeves under pavement: provide a permanent identifying marker above sleeve on top of curb. Confer with the Owner's representative for type of marker.

E. Solvent Weld Joint:

1. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust and moisture.
2. Dry-insert pipe into fitting. Pipe should enter fitting 1/3 to 2/3 depth of socket.
3. Coat the inside socket surface of the fitting and the external surface of the male end of the pipe with P-70 primer (manufactured by Weld-On or approved equal). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.
5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
6. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

F. Threaded Joint:

1. Field threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.
2. Factory-made nipples shall be used wherever possible. Field-cut threads in metallic pipe will be permitted only where approved by the Owner's representative. When field threading, cut threads accurately on axis with sharp dies.
3. All threaded joints except those directly contacting sprinkler or bubbler inlets shall be made up with pipe joint compound. Apply compound to male threads and first two female threads.
4. Where assembling metallic pipe to metallic fitting or valve, no more than one full turn beyond hand tight.
5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
6. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.

G. Cap or plug openings as pipeline are assembled to prevent entrance of dirt or obstruction. Remove caps or plugs only when necessary to continue assembly.

H. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

### 3.8 MASTER CONTROL VALVE

- A. Provide excavation and backfill, furnishing, installing and testing of fittings, and valve, and other Work in accordance with the Drawings and Specifications.
- B. Install where shown on Drawings, where practical, and in landscape areas.
- C. Thoroughly flush main line pipe before installing valve.
- D. Label valve with a identification tag, indicating satellite controller letter designation of valve. Permanently attach label to control solenoid wire.

### 3.9 FLOW SENSOR

- A. Install flow sensor in main line fitting as detailed.
- B. Adjust flow sensor as instructed in manufacturer's installation instructions to provide accurate and proper flow data to be received by satellite controller. Request the assistance of a manufacturer's representative at time of installation if manufacturer's installation instructions are not fully understood.
- C. Connect specified sensor communication wiring to designated satellite controller.
- D. Install flow sensor cable in 1-1/2" schedule 40 PVC conduit from satellite controller to flow sensor valve box. Provide 14 x 19 plastic pull boxes every 100 feet along cable routing with sweep ells into pull box. Seal the ends of the conduit with a silicone sealant to prevent entry of water. Do not splice the flow sensor cable.
- E. Flow sensor cable cannot exceed 2000 feet in total length of cable.

### 3.10 REMOTE CONTROL VALVES

- A. Install where shown on approved Drawings and group together where practical.
- B. Provide only one remote control valve per box without exceptions.
- C. Locate valve boxes behind second row of shrubs and perpendicular to walk edges buildings and walls. Provide 12" between valve boxes where valves are grouped together.
- D. Thoroughly flush main line before installing valves.
- E. Install in shrub or ground cover areas where possible.
- D. Label control line wire at each valve with a 2 1/4" x 2 3/4" polyurethane I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.

### 3.11 VALVE BOXES

- A. Permanently mark each valve controller station number on lid of valve box by heat branding. Letters and numbers are to be 2-1/2" high. Do not use paint.

### 3.12 AUTOMATIC CONTROL WIRING

- A. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply wherever possible. When not possible, install wiring in PVC conduit as described in "Sleeving and Conduit" section.
- B. Splicing of low voltage control wire shall be placed in remote control valve boxes. Indicate all splices on the As-Built Plan.
- C. Connections shall be made with 3M-DBY sealing connectors and per manufacturer's instructions.
- D. Label wires at the controller with the station number.

### 3.13 CONTROLLER

- A. Provide and install irrigation controller in enclosure and at locations shown on Drawings. Provide conduit and wire and connect to existing 120-volt service accessible to controller for ease of maintenance.
- B. Connect control lines to controller in sequential arrangement according to assigned identification number of valve and in geographic order. Each control line wire shall be labeled at controller.

### 3.14 TESTING

- A. Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.

### 3.15 SPRINKLER HEADS, BUBBLERS, AND QUICK COUPLER VALVES

- A. Thoroughly flush lines before installing heads, bubblers, or QCVs.
- B. Locate heads, bubblers, and QCVs as shown in the Drawings and details.
- C. Adjust sprinkler nozzles and bubbler outlets for proper distribution and trim.
- D. Sprinklers are to be a minimum of 6-inches from walkways, fences, curbs, etc. and 8-inches from buildings and other permanent structures.

### 3.16 FIELD QUALITY CONTROL

- A. Adjustment of the System:

1. Flush and adjust all sprinkler heads and bubblers for optimum performance and to eliminate overspray onto walks, roadways and buildings.
2. If it is determined that adjustments in the irrigation equipment will provide proper and more uniform coverage, the contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
3. Lowering raised sprinkler heads by the contractor shall be accomplished within ten days after notification.

### 3.17 TESTS

Contractor shall:

- A. Notify the Owner's representative at least three (3) days in advance of testing.
- B. Testing shall be performed at the Contractor's expense.
- C. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
- D. Apply the following tests after solvent weld plastic pipe joints have cured at least 24 hours.
  1. Solvent weld: Test supply lines per ASTM-F690 as follows: (1) add water slowly to pipe to avoid water and air hammer damage; (2) bleed air out of system through quick coupling valves to insure air is exhausted; (3) pressurize system to 120 psi for 24 hours. Visually inspect for leaks while system is holding pressure constant. Note - use hydraulic pump or other safe method - do not use air compressor. Make tests and repairs as necessary until test conditions are met.
  2. Test RCV controlled lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.
- E. When the irrigation system is completed, perform a coverage test to determine if the water coverage for planting areas is complete and uniform without overspray onto adjacent paved areas. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviation from drawings. This test shall be accomplished before any groundcover is planted.
- F. No planting is to commence until a coverage test has been completed in the presence of the Owner's representative, the entire system is fully automatic, and there has been a 14 day watering period.

### 3.18 GUARANTEE

- A. Fill and repair all depressions and replace all necessary surfaces and planting due to the settlement of irrigation trenches for one year following completion and acceptance of the job work of this section.

- B. Guarantee all materials, equipment and workmanship to be free of all defects of workmanship and materials. Agree to replace at Contractor's expense, at any time within one year after installation is accepted, any and all defective parts.

### 3.19 CLEAN-UP

- A. When work of this section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials and equipment from site. At no time shall debris, surplus materials and equipment be placed on adjacent property unless said location is approved by the Owner's representative and with written permission from the property owner.



## GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications. We agree to repair or replace any defects in material or workmanship, any settling of backfilled trenches, which may develop during the period of one year from date of acceptance and also to repair or replace any damage caused by and defects in the irrigation system or resulting from the repairing or replacing of such defects at no additional cost to the Owner. Ordinary wear and tear, unusual abuse or neglect is accepted. We shall make such repairs or replacements, including complete restoration or all damaged planting, paving, or other improvements of any kind, within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project:

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Location:

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Contractor:

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License

No.:

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Address:

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Telephone:

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Guarantee

To:

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Date

of

Acceptance:

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Authorized

Representative:

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HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
CMG Landscape Architecture

IRRIGATION SYSTEM  
02810-14  
11/10/2014

END OF SECTION

SECTION 02870  
SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following site furnishings:
  - 1. Manufactured Benches
  - 2. Manufactured Picnic Tables
  - 3. BBQ Grill and Hot Coal Bin
  - 4. Bicycle Racks
  - 5. Drinking Fountain
  - 6. Trash and Recycling Receptacles
  - 7. Tree Grates
  - 8. Skateboard Deterrents
  - 9. Signs
  - 10. Custom Furnishings "Raft Bench"
- B. Work Specified Elsewhere:
  - 1. Section 02775 – Concrete Paving
  - 2. Section 03300 – Cast In Place Concrete
  - 3. Section 03450 - Architectural Precast Concrete
  - 4. Section 05501 - Site Metal Fabrications
  - 5. Section 06210 – Site Finish Carpentry

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Include shop drawings, construction details, material descriptions, dimensions of individual components and profiles, finishes, colors, field-assembly requirements, and installation details for Tree Grates and Custom Raft Bench.
- C. Include shop drawings, construction details, material descriptions, dimensions of individual components and profiles, finishes, colors, field-assembly requirements, and foundation and adjacent paving coordination details for Manufactured Benches and Picnic Tables, Grill and Hot Coal Bin, Bicycle Racks and Drinking Fountain.

- D. Include shop drawings for layout of the Skateboard Deterrents at CIP concrete walls. Include construction details to coordinate skate deterrent attachment to concrete walls.
- E. Include shop drawings, construction details, material descriptions, dimensions of individual components and profiles, finishes, colors, field-assembly requirements and text layout for verification for Park Signage Name and Park Rules.
- F. Samples for Verification:
  - 1. Skate deterrent – (1) representative deterrent and attachment hardware
  - 2. For each type of exposed finish on site furnishings:
    - a. Size: Not less than 3-inch by 3-inch. Include sealants as applicable.
- G. Material Certificates:
  - 1. Wood Preservative Treatment: Include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  - 2. Sustainably Harvested Wood: Include certification by manufacturer and from sources that participate in sustained yield programs.
- H. Shop Drawings
  - 1. Provide shop drawings for all site furnishings.
  - 2. Detail hardware and connections. Include base mounting templates to coordinate anchor bolt locations and footings.
  - 3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
  - 4. Include plans and elevations showing unit location and sequence of erection for special conditions.
  - 5. Indicate devices or attachment points for lifting, transport and installation.
  - 6. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of site furnishing through one source from a single manufacturer.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free from surface blemishes and complying with the following:

1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211
2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221
3. Structural Pipe and Tube: ASTM B 429.
4. Sheet and Plate: ASTM B 209

B. Steel: Free from surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 569/A 569M and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 569/A 569M.

C. Stainless Steel: Free from surface blemishes and complying with the following:

1. Marine grade and appropriate to assure no rusting or staining. Contractor is responsible to ensure material is suitable for project environment.
2. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
3. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312 M.
4. Tubing: ASTM A 554.

D. Anchors, Fasteners, Fittings, and Hardware: Stainless steel, Galvanized steel, and Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality; tamperproof, vandal and theft resistant, concealed. Provide as required for site furnishings' assembly, mounting, and secure attachment, and as per drawings.

E. Wood Sealants: Contractor shall recommend sealants as per manufacturer for pre-fabricated furnishings or as appropriate for custom furnishings. Ensure sealants are compatible with micro climate of project location. Include data regarding weathering, maintenance and reapplication schedule.

F. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

G. Galvanizing: Where indicated for steel components, provide the following protective zinc coating applied to components after fabrication:

1. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

## 2.2 BENCHES

A. Bench Type SF1-A: Knight Bench with Back

1. Manufacturer: Forms and Surfaces, Local Rep: Michael Risso (925) 890-4623, [www.forms-surfaces.com](http://www.forms-surfaces.com)
  2. Model: Knight Series: 6' (SBKNI-072B) or 8' (SKBKNI-096B) Long Bench with Back, with armrests at ends of bench. See Site Plan Series for locations.
  3. Materials: Aluminum frame with Ipe wood slats
  4. Installation: Install per manufacturer. See Drawings for embed and surface mount details.
  5. Attachment hardware: Install per manufacturer and secure with tamper resistant fastener
- B. Bench Type SF1-B: Knight Bench without Back
1. Manufacturer: Forms and Surfaces, Local Rep: Michael Risso (925) 890-4623, [www.forms-surfaces.com](http://www.forms-surfaces.com)
  2. Model: Knight Series: 8' (SBKNI-096N) Long Bench without Back, with armrests at ends of bench
  3. Materials: Aluminum frame with Ipe wood slats
  4. Installation: See Drawings and Install per manufacturer
  5. Attachment hardware: Install per manufacturer and secure with tamper resistant fastener

## 2.3 BICYCLE RACKS

- A. SF-4: Welle Circular Rack
1. Manufacturer: BikeParking.com, 415.333.6428
  2. Model: Welle Circular Rack, Surface Flange, #WCR02-SQ-SF-G
  3. Materials: 2"x2"x0.188" Square Steel Tube
  4. Mounting: Surface mounted as shown in Drawings. Finished surface to be finished concrete paving as shown in Drawings.
  5. Finish: Hot Dipped Galvanized
  6. Location: Hillpoint and Innes Court Parks

## 2.4 TRASH AND RECYCLING RECEPTACLES

- A. SF-6 Urban Renaissance Trash and Recycling Receptacle
1. Manufacturer: Forms and Surfaces, Local Rep: Michael Risso (925) 890-4623, [www.forms-surfaces.com](http://www.forms-surfaces.com)
  2. Model: Urban Renaissance Model No. SLURB-36RBU, 36 Gallon, Side Opening with integrated Recycle Bin, and Updrop Grillwork
  3. Mounting: Drill and epoxy as indicated on drawings.
  4. Attachment hardware: Install per manufacturer and secure with tamper resistant fastener
  5. Finish: Powder coat – Argento Texture

## 2.5 PARK GRILL

- A. SF 3-A: Pilot Rock Premier Series Park Grill
1. Manufacturer: Pilot Rock 1(800) 762-5002, [www.pilotrock.com](http://www.pilotrock.com)
  2. Model: A20 B2 on post with 360 swivel

3. Mounting: Embedded in below grade concrete footing as shown in Drawings. Finished surface to be finished concrete paving as shown in Drawings.
4. Color: Black

## 2.6 PARK GRILL HOT COAL BIN

- A. SF3-B: Pilot Rock Coal Bin
  1. Manufacturer: Pilot Rock 1(800) 762-5002, [www.pilotrock.com](http://www.pilotrock.com)
  2. Model: HCB/B-1
  3. Mounting: Ground Anchor M9/B
  4. Attachment hardware: Install per manufacturer and secure with tamper resistant fastener
  5. Color: Black
  6. Accessories: 31 gal Ash Can CNG-231OC with Heavy Duty Pad Lock and Key sets

## 2.7 DRINKING FOUNTAIN

- A. SF-5: Drinking Fountain with Attached Pet Fountain
  1. Manufacturer: Most Dependable Fountains, Inc. 1 (901) 867-0039 [www.mostdependable.com](http://www.mostdependable.com)
  2. Model: 440DB SS with PF – chrome with attached valve box
  3. Mounting: Direct Bury Embedment Mount. Install according to Manufacturer. Finished paving surface at fountain to be finished concrete paving as shown in Drawings.
  4. Finish: Powdercoat color “Chrome”

## 2.8 PICNIC TABLE

- A. SF-2: Greenway Series Picnic Table
  1. Manufacturer: Timberform, Local Rep: Ted Jonsson (415) 317-7275
  2. Model: 2163-6, 8' Length, ADA Accessible
  3. Materials: Steel Frame and Ipe Wood Slats
  4. Mounting: Embedded in below grade concrete footing as shown in Drawings. Finished surface to be finished as shown in Drawings.
  5. Finish: Black Powder-Coated Steel Frame. No Sealant on Ipe Wood Slats.

## 2.9 PARK SIGN

- A. SF-13: Park Sign Exhibit Base
  1. Manufacturer: KVO Industries – Keith Keeler/1.717.573.6868 / [keith@kvoindustries.com](mailto:keith@kvoindustries.com)
  2. Model: Slimline Exhibit Base 1824 SL SLP-AL
  3. Mounting: Embed mount with concrete footing per manufacturer's recommendation
  4. Finish: Powdercoat Black Cardinal T241-BK59
- B. SF-13: Park Sign Exhibit Panel

1. Manufacturer: KVO Industries – Keith Keeler/1.717.573.6868 / keith@kvoindustries.com
2. Material: Exterior grade high pressure laminate
3. Size: 18" x 24"
4. Mounting: Mount on Slimline Exhibit Base
5. Sign Panel Contents and Graphic Design – to be provided by Owner

## 2.10 SKATE DETERRANT

- A. SF-15: Skatestopper Skate Deterrent
  1. Manufacturer: Skatestoppers El Cajon, CA 92020 (619) 447-6374  
www.skatestoppers.com
  2. Model: Laser Series Morgan with 0.50" radius
  3. Material: White Tombasil  
Attachment hardware: Install per manufacturer. Anchor with 2 blind "Smart Pins Plus" anchors pins and impact resistant epoxy.

## 2.11 TREE GRATE

- A. SF-7: Urban Accessories Tree Grate
  1. Manufacturer: Urban Accessories; David O'Keefe Co. Contact: Tom or Stephanie T: 925-385-0638
  2. Model: Flat Rainbow
  3. Size: 6'-0" Diameter
  4. Material: Cast Ductile Iron
  5. Custom: cast (2) 3" holes for tree stakes & provide (2) 4" holes for irrigation access with cast metal cover plates - provide shop drawings to locate.

## 2.12 SF-14: FURNISHING 'RAFT BENCH'

- A. See Drawings for wood materials. The intent is to use wood products reclaimed from the project's Shipyard site. Substitutions will be considered based on meeting this intent, and appropriateness for application as an outdoor seating element. Contractor shall be responsible for all milling, joining and finishing of selected material.
- B. Refer to Section 05501 – Site Metal Fabrications for bench back rest.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 PREPARATION

#### A. Concrete Pads and Footings

1. Layout: Accurately lay out all pads and footings as called for in the Drawings.
2. Installation: Excavate form as required and fill for pads and footings as specified in Section "Concrete Paving" and "Cast in Place Concrete".

### 3.3 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.
- B. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.
- C. Install site and street furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

### 3.4 CLEANING

- A. After completing site and street furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 02870

SECTION 02910  
SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide all soil and soil amendments products, including all imported topsoil as required to make up deficiencies in quantity and quality of soil available on site. Execute all labor to achieve soil preparation, complete, as shown and as specified.
- B. During site mass grading operations in 2007, preexisting site topsoil was stockpiled, tested for agricultural suitability, and placed as top 2 feet of fill for landscape areas in the parks. Refer to Hunters Point Shipyard Development Project Parcel A' – "Grading and Retaining Walls" As Built documents for previous soil reports and placement locations.
- C. For the purposes of the soil work under this contract, planting soil will be considered the top 8" of soil to be "top soil" and the lower 6" to be "subsoil." Amend and cultivate the top 14" of soil in landscape areas for planting soil. 2" minimum mulch bed. Maximum soil compaction in planting areas to be 85%. See Drawings.
- D. Products Installed But Not Furnished Under This Section:
  - 1. Landscape Drainage, Perforated Pipe, Drainage Fabric
- E. Work Specified Elsewhere:
  - 1. Earthwork: Section 02300
  - 2. Finish Grading: Section 02310
  - 3. Structural Soil: Section 02320
  - 4. Irrigation: Section 02810
  - 5. Lawns and Grasses: Section 02920
  - 6. Planting Section: 02930

1.2 DEFINITIONS

- A. Existing Topsoil: Area of undisturbed existing soil where no additional rough grading is to be done. No topsoil is to be placed. Only surface cultivation and soil amending are included in this Section.
- B. Subgrade: Soil level below topsoil resulting from the rough grading work under another Section. Cultivation of all subgrade areas prior to amending is included in this section.

- C. Topsoil: Site soil stockpiled for spreading over prepared subgrade.
- D. Imported Topsoil: Offsite topsoil imported and stockpiled under this Section, to be spread and amended also as work under this Section.
- E. Landscape Planting Soil: The top 8" of soil to be "top soil" and the lower 6" to be "subsoil." Amend and cultivate the top 14" of soil in landscape areas for planting with a 2" minimum mulch bed. Maximum soil compaction in planting soil areas to be 85%.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's current catalog cuts and specifications of the following:
  - 1. Fertilizer
  - 2. Herbicide
  - 3. Filter Fabric
- B. Quality Control Submittals:
  - 1. Testing Agency Qualifications: Soil and Plant Laboratory, Inc., 352 Matthew Street (P.O. Box 153), Santa Clara, CA 95052, Tel. (408) 727-0330; or Root Zones Associates, P.O. Box 18911, San Jose, CA 95118, Tel. (408) 264-7024.
    - a. Test Reports:
      - i. Existing, Stockpiled and Imported Topsoil: Provide testing, analysis, and amendment recommendations of all soils conditions within the project planting areas. Testing analysis shall include pH, salinity, sodium hazard, boron hazard, lime content, organic matter on a dry weight basis, quality of organic matter based on total nitrogen and total organic (C:N analysis), soil texture, and nutrients, non-essential trace metals, and state of aeration. Laboratory to make amendment recommendations based on an organic approach to soil and landscape management based on topsoil and organic amendment specifications in this section. Soils analysis must be certified and current (within 120 days).
    - b. Test Locations: Sample soil locations for each planting area type in each park – tree planting pit, shrub planting areas, lawn sod area and hydroseed grassland area. Confirm locations with Landscape Architect prior to collecting samples.
    - c. Certificates: Certify strict compliance with accepted soil mixes and amendments, including rate of application.

## 2. Soil Reports:

- a. Source Control Report: For preparation of control mix by owners testing laboratory, submit to testing laboratory. Take samples in volume and quantity for each soil mix as directed by soil testing lab.
  - b. Soil Analysis: Test for the specified characteristics. Provide interpretation of analytical data. Continue to sample and retest until each proposed soil type conforms to the specified characteristics. Pay for all such testing.
  - c. Interpretation: Submit planting and soil preparation specifications, plant schedule and plans to testing agency and require testing agency to report on suitability of proposed soil mixes for associated plant materials as indicated on the plant schedule. Testing agency to propose amendments and conditioners required to produce suitable soils. Contractor responsible for coordinating testing agency recommendations with project specifications.
  - d. Field Quality: Submit to owners testing laboratory one-quart samples prepared mix for each 100 cubic yards prepared (minimum 2 samples) for testing with laboratory prepared control mix.
  - e. Analytical deviations greater than +/-20% between control mix and field mix test results may allow rejection of batches of prepared mix. Correct any deficiencies and/or discrepancies between laboratory Control Mixes and bulk field mixes to the satisfaction of the Owner.
3. Field Observation: Give not less than 14 working days notice so that field observations may be made of the following:
- a. Drainage test of tree planting pits – Section 02930 Planting.
  - b. Finish grading operations - Section 02310

## 1.4 FIELD QUALITY CONTROL

- A Tests: Right is reserved to take samples of soil mixes and prepared soil for testing for conformity to Specifications.
- B Rejected Materials: Remove off site at Contractor's cost. Pay cost of testing of materials, not meeting Specifications.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A Existing Topsoil:

1. Quantity: Native topsoil has been stockpiled and placed onsite under a separate contract and is the existing condition. Contractor is responsible for testing and amending placed topsoil to required depths as part of this contract.
2. Suitability: Contractor is responsible for suitability testing.

B Imported Topsoil:

1. Quantity: Quantity of import topsoil to complete the work shall be calculated by the Contractor.
2. Stockpiling: Stockpile on site as directed by Owner.
3. Rejected Topsoil: Immediately remove rejected topsoil off the site at Contractor's expense.
4. Composition:

- a. USDA classification of fraction passing 2.0-mm sieve: sandy clay loam, clay loam or loam and conforming to the following:

| <u>Class</u>  | <u>Particle size range</u> | <u>maximum, %</u>                   | <u>minimum, %</u> |
|---------------|----------------------------|-------------------------------------|-------------------|
| Coarse sand   | 0.5 - 2.0 mm               | 15                                  | 0                 |
| Silt          | .002-.05 mm                | 40                                  | 25                |
| Clay          | <.002 mm                   | 35                                  | 20                |
| Other classes |                            |                                     |                   |
| Gravel        | 2 - 13 mm                  | 15                                  | 0                 |
| Rock          | 1/2 - 1 inch               | 5%                                  |                   |
|               |                            | <u>by volume</u> with none > 1 inch |                   |
| Organic       |                            | 15 %                                | 0                 |

- b. Chemistry - Suitability considerations

Salinity: Saturation Extract Conductivity (EC<sub>e</sub>)  
Less than 3.0 dS/m @ 25° C.

Sodium: Sodium Adsorption Ratio (SAR)  
Less than 6.0

Boron: Saturation Extract Concentration  
Less than 1.0 ppm

Reaction: pH of Saturated Paste: 5.5 - 7.8  
without high lime content.

- c. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.

## 2.2 TREE, SHRUB AND GROUNDCOVER PLANTING SOIL MIX

- A. Tree Shrub and Groundcover Planting Soil Mix below is for bid purposes only. Final soil mixes shall be determined by the soils testing agency.

- B. Tree, Shrub and Groundcover Planting Pits

### Tree Backfill Mix

|          |  |
|----------|--|
| 3 parts  | Pulverized Site Soil or approved topsoil   |
| 1/2 part | Nitrogen/Iron Stabilized Organic Amendment |

### *Uniformly Blended with*

### Amount / Cubic Yard of Backfill Mix

|           |                              |
|-----------|------------------------------|
| 1/2 pound | 60-20-20 Complete Fertilizer |
| 1/2 pound | Potassium sulfate (0-0-50)   |
| 1 pound   | Soil Sulfur                  |
| 3 pounds  | Agricultural Gypsum          |

\* The top 12 inches of tree pits may be backfilled with amended subgrade and/or approved topsoil.

- C. Testing agency to provide amendment, conditioners, fertilizer recommendations based on plant schedule. Contractor to submit plant schedule, plans and specifications to testing agency.

## 2.3 ACCESSORIES

- A Fine Sand:

- 1. Physical Properties (by dry weight basis):

| <u>Percent Passing</u> | <u>Sieve Size</u>           |
|------------------------|-----------------------------|
| 100                    | 4.76 mm(#4, 4 mesh)         |
| 95-100                 | 1.00 mm (#18, 16 mesh)      |
| 65-100                 | 500 micron (#35, 32 mesh)   |
| 0- 50                  | 250 micron (#60, 60 mesh)   |
| 0- 20                  | 105 micron (#140, 150 mesh) |

0- 5                      53 micron (#270, 270 mesh)

2. Chemical Properties: (by Saturation Extract Method):

- a. Soluble Salts/Salinity: Maximum conductivity of 3.0 milliohms/cm at 25 degrees C.
  - b. Boron: Maximum concentration of 1.0 ppm.
  - c. Sodium Absorption Ratio (SAR): Maximum 6.0.
- B Pre-emergence Weed Control: "Treflan 5G", by Elanco Products Co., (317) 261-3638, or (209) 486-3020 or "Enide 50W", by TUCO, (616) 385-6609.
- C Water: Clean, fresh and potable, as available from Owner. Transport as required.

## 2.4 ORGANIC COMPONENTS

A Peat Moss:

1. Type: Finely-shredded, brown in color, suitable for horticultural purposes and frequently referred to in the trade as "greenhouse" or "coarse grind".
2. Measurement: Measure peat in air dry condition, containing not more than 35% moisture by weight on an "as-received" basis. Ash content shall not exceed 10%.
3. Physical Properties:

Percent Passing Sieve Size

|        |                           |
|--------|---------------------------|
| 95-100 | 9.51 mm (3/8 in.)         |
| 0- 40  | 500 micron (#35, 32 mesh) |

4. Organic Content (dry weight basis): 90-100%
5. Chemical Properties:
  - a. Nitrogen (dry weight basis): 0.6-3.0%
  - b. Salinity/Soluble Salts: Saturation extract conductivity 0.0-3.0 millimhos/cm @ 25 degrees C.
  - c. pH: 3.0-4.5
6. Acceptable Substitute: Ground redwood bark by Lindauer Products, Santa Rosa, CA, per specifications for peat moss.

B Nitrogen-Treated Sawdust:

1. Type: Derived from redwood, fir or cedar wood sawdust.
2. Physical Properties:

| <u>Percent Passing</u> | <u>Sieve Size</u>         |
|------------------------|---------------------------|
| 95-100                 | 6.35 mm. (1/4 in.)        |
| 80-100                 | 2.38 mm. (#8, 8 mesh)     |
| 0- 30                  | 500 micron (#35, 32 mesh) |

3. Chemical Properties:

- a. Nitrogen content (dry weight basis):
- b. Wood of Redwood 0.4 - 0.6%
- c. Wood of Fir/Cedar 0.56 - 0.84%
- d. Iron content (dry weight basis): 0.08% iron as metallic, minimum.
- e. Salinity/Soluble salts: Maximum 3.5 millimhos/cm 25 degrees C. as determined by saturation extract method.
- f. Ash (dry weight basis): 0 - 6.0 percent maximum.

C Treated Fir/Pine Bark:

1. Physical Properties (dry weight basis):

| <u>Percent Passing</u> | <u>Sieve Size</u>         |
|------------------------|---------------------------|
| 95-100                 | 6.35 mm (1/4 in.)         |
| 80-100                 | 2.38 mm (#8, 8 mesh)      |
| 0- 30                  | 500 micron (#35, 32 mesh) |

2. Organic Content (dry weight basis): 94 percent minimum as determined by ash analysis.

3. Chemical Properties:

Nitrogen Content (dry weight basis): 0.8 percent minimum.

Soluble Salts/Salinity: Maximum Saturation Extract Conductivity 3.0 millimhos/cm at 25 degrees C, by method.

Iron (dry weight basis): 0.08 percent minimum.

pH: 6.5 - 7.5



4. Wettability:

- a. When applied to a cup or small beaker of water @ 70 degrees F. in the amount of 1 teaspoon, the air-dry product shall become completely wet in a period not exceeding 2 minutes.
- b. All wetting agents to be non-phytotoxic at rate used.

2.5 COMMERCIAL FERTILIZERS

A Pre-Plant Fertilizer:

1. Type: Mixed by a commercial fertilizer supplier and consisting of the following percent by weight: 24-6-10
2. Manufacturer: Sierra Grace - 1-800-492-8255.

2.6 CHEMICAL COMPONENTS: The following additives may or may not be used depending on the outcome of the soils report.

- A Ground Limestone: Agricultural limestone containing not less than 85% of total carbonates, ground to such fineness that 50% will pass #100 sieve and 90% will pass #20 sieve.
- B Dolomite Lime: Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing #65 sieve. "Kaiser Dolomite 65 AG" by Kaiser, Inc. Mineral Products Department, or accepted equal.
- C Gypsum: Agricultural grade product containing 80% minimum calcium sulfate.
- D Iron Sulfate: Supplied by a commercial fertilizer supplier, containing 20% to 30% iron and 35% to 40% sulfur.
- E Sulfate of Potash: Agricultural grade containing 50% to 53% of water-soluble potash.
- F Single Superphosphate: Commercial product containing 20% to 25% available phosphoric acid.
- G Ammonium Sulfate: Commercial product containing approximately 21% ammonia.
- H Ammonium Nitrate: Commercial product containing approximately 34% ammonia.
- I Calcium Nitrate: Agricultural grade containing 15-1/2% nitrogen.
- J Urea Formaldehyde: Granular commercial product containing 38% nitrogen.

- K I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31% nitrogen.
- L Soil Sulfur: Agricultural grade sulfur containing a minimum of 96% sulfur.
- M Iron Sequestrene: Geigy Iron Sequestrene 330 Fe, by Ciba-Geigy Corporation, (919) 292-7100.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. For the purposes of the soil work under this contract, planting soil will be considered the top 8" of soil to be "top soil" and the lower 6" to be "subsoil." Amend and cultivate the top 14" of soil in landscape areas for planting soil. 2" minimum mulch bed. Maximum soil compaction in planting areas to be 85%. See Drawings.

### 3.2 SOIL MOISTURE CONTENT

- A General: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting.
- B Range: Maintain within 2 percent above or below optimum moisture content at all times during the work.

### 3.3 SUBSOIL PREPARATION AND AMENDMENT

- A Clearing: Clear all planting areas to a subsoil depth of 6 inches of stones 1-1/2 in. diameter and larger, weeds, debris and other extraneous materials prior to soil preparation work.
- B Subgrade Preparation
  - 1. Verification:
    - a. Verify that subgrades for installation of topsoil have been established under rough grading. Do not spread or amend topsoil prior to acceptance of subgrade work.
    - b. Depth: Verify that subgrades are 6 in. minimum below finished grades, plus or minus 1 inch. Report all variations.

2. Cultivation: Rip or cultivate planting area subgrades to a depth of 6 - 8 in. immediately prior to applying top soil or soil amendments or as per the soils Testing Agency.

C Subsoil Amendment:

1. As per the soils Testing Agency

3.4 SPREADING OF TOPSOIL

- A General: Spread Stockpiled topsoil over accepted subgrade prior to incorporating amendments.
- B Restrictions: Do not commence spreading of topsoil prior to acceptance of subsoil preparation and amendment above. Do not place topsoil under muddy conditions.
- C. Topsoil Depth: Minimum depth of 8 in. after natural settlement and light rolling conforming to finished grades shown on Drawings.

3.5 TOPSOIL AMENDMENT

A Stockpiled Native Topsoil

1. Amend soils as per Soils Testing Agency recommendations.
2. Evenly spread and thoroughly blend the amendment materials based on the amendment schedule provided by the testing agency into the top 8 inches of soil to form a homogenous layer.

B Import Topsoil: Amend soils as per Soils Testing Agency recommendations

3.6 PRE-EMERGENT HERBICIDE

- A Apply pre-emergent weed control to all (on-grade) areas to receive woody, non-lawn ornamental planting after incorporating soil amendments.
- B Apply strictly according to manufacturer's current printed specifications.

END OF SECTION

SECTION 02920  
LAWNS AND GRASSES

PART 1 - GENERAL

1.01 SUMMARY

- A Work Included: Provide lawns and grasses, complete as shown and as specified.
- B Work Specified Elsewhere:
  - 1. Earthwork: Section 02200
  - 2. Finish Grading: Section 02310
  - 3. Soil Preparation: Section 02920
  - 4. Irrigation System: Section 02810
  - 5. Planting: Section 02930
  - 6. Landscape Maintenance: Section 02935

1.02 REFERENCES

- A Hortus III - 1976 Edition, Bailey Hortorium, Cornell University.
- B Technical Association of the Pulp and Paper Industry for Wood Cellulose

1.03 SUBMITTALS

- A Product Data: Manufacturer's current catalog cuts and specifications for incorporated fertilizer, mulch.
- B Sod Materials: Seed Mix and Product Data.
- C Hydroseed mix design and product data for materials included in mix.
- D Certificates:
  - 1. Certificates of inspection as required by law for transportation of each shipment of seed and sod along with invoice.
  - 2. Seed mix certificate including incorporated fertilizer and rate of application for hydroseeding. Statement shall verify compliance with weed content specification set forth in seeding schedules.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

##### A Seed:

1. Delivery: Furnish standard seed in unopened manufacturer's standard containers bearing original certification labels showing quantity, analysis and name of manufacturer.
2. Storage: Protect seed from weather or other conditions that would damage or impair the effectiveness of the product.

##### B Sod:

1. Harvest and Delivery: Harvest from the source and deliver to project site within 24 hours. Deliver only as much sod as can be installed in one day's work.
2. Review: Sod not transplanted within this time period shall be reviewed prior to installation.

##### C Mulch:

1. Labeling: Each package of cellulose fiber shall be marked by the manufacturer to show the air-dry weight content.
2. Storage: Protect from weather or other conditions that would damage or impair the effectiveness of the product.

#### 1.05 PROJECT/SITE CONDITIONS

- A Climate Restrictions: Do not install lawns and grasses during rainy weather.

#### 1.06 TIMING OF INSTALLATION

##### A Seeding:

1. Within fourteen (14) calendar days after the completion and acceptance of finish grading in any area.
2. Seeding will take place prior to the onset of winter rains but no later than October 15.

##### B Sod

1. Immediately after finish grading and irrigation installation are accepted.

## 1.07 PERFORMANCE CRITERIA

- A Time Period: Warrant that lawns and grasses shall be in a healthy and flourishing condition of active growth twelve (12) months from date of Final Acceptance.
- B Appearance: Lawns and grasses shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.
- C Delays: Delays caused by the Contractor in completing planting operations, which extend the planting into more than one planting season, shall extend the Warranty Period correspondingly.
- D Coverage: Warrant growth and coverage of seeded planting to the effect that a minimum of 95% of the area planted shall be covered with specified planting after one growing season with no bare spots.
- E Invasive Exotic Plant Species: Invasive exotic plant species are those species classified as List A and List B species by the California Invasive Plant Council. By the end of the 12 month time period, absolute cover by invasive exotic plants in the seeded areas shall not exceed 10 percent of the total seed area in any 100 sf plot. Cover will be estimated by absolute cover class (<5 percent, 5-15 percent, 16-25 percent, 26-50 percent, 51-76 percent, 76-100 percent) for each species (specified and exotic).
- F Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or Acts of Nature during Maintenance Period. Report such conditions in writing.

1.08 MAINTENANCE: See Section 02970 - Landscape Maintenance.

## PART 2 - PRODUCTS

### 2.01 GRASS SEED

- A Composition: Fresh, clean, certified, new seed, species as indicated in Drawings.
- B Weed Seed: Do not exceed 0.25%.
- C Minimum pure live seed and germination shall be as indicated in the seeding schedules on the drawings. If minimum germination and purity rates cannot be met with available seed, Contractor shall compensate by furnishing additional seed at no additional cost to the Owner. Comparison shall be made on the basis of Pure Live Seed (PLS) in pounds. The formula for determining PLS shall be Pounds of Seed x (Purity x Germination) = Pounds of PLS.

2.02 SEED MIXES: Quantity and rate of application as indicated in Drawings.

- A Slope Hydroseed Mix
- B Ditch Hydroseed Mix
- C Habitat Mix 'Bay Area'

2.03 LAWN SOD

- A Composition: 'New Century Blend' Dwarf Tall Fescue, or equal.

Supplier:  
Pacific Sod, Inc.  
Patterson, CA 95352  
Tel. (800) 692-8690 or

- B Prior to harvesting, mow sod to a uniform height of between 1 1/2 to 2 inches for shipment. Roll/fold sod with the soil facing out to protect the grass from damage. Ship sod sufficiently dry for transportation and handling, yet moist enough to facilitate installation.
- C Sod shall be dense, healthy, field-grown on fumigated soil.
- D Sod shall be dark green in color, free of thatch, free from diseases, weeds and harmful insects.
- E Sod shall be reasonably free of objectionable grassy and broadleaf weeds. Sod shall be considered weed free if no more than ten (10) such weeds are found per 100 sq. ft. of sod.
- F Sod shall be rejected if found to contain weeds.

2.05 ACCESSORIES

- A Water: Potable water as furnished by Owner. Transport as required.
- B Mulch:
  - 1. Composition: Fibrous, 100% virgin wood fiber mulch containing no growth or germination-inhibiting factors.
  - 2. Weight: Weight specification refers only to air-dry weight of the fiber material. Absolute air-dry weight is considered equivalent to 10% moisture.

3. Dispersion in Slurry: Mulch shall be manufactured in such manner that after addition to and agitation in slurry tanks with fertilizer, seed, water and other approved additives, fibers in the material will become uniformly suspended to form a homogeneous slurry.
4. Absorption Capacity: When hydraulically sprayed on the ground, the material will form a blotter-like groundcover impregnated uniformly with seed, which will allow the absorption of moisture and allow rainfall to percolate to the underlying soil.
5. Product: "Silva-Fiber" by Weyerhaeuser Co., (206) 924-2345, "X-100 Spramulch" by Pacific Wood Fibers (206) 885-1341, or "Conwed Fiber" by Conwed Corporation (612) 221-1190.

C Soil Stabilizer:

1. Composition: Totally organic substance, supplied in powder form and at least 90% of which is 92% pure muciloid derived from ground Plantago ovata-insularis husks. Stabilizer shall be water-soluble, non-toxic hydrophilic and shall not inhibit germination.
2. Product: "Ecology Controls M-binder" by Ecology Controls, (213) 877-8600, or "R-Binder" by Clyde Robin Seed Co., (415) 785-0425. Or equal.

D Mulch and Soil Stabilizer:

1. Composition: Pre-mixed, organic-based combination of virgin-wool fiber and stabilizing agent with no growth or germination-inhibiting elements.
2. Product: "Hydro Mulch 2000 Fiber" by Conwed Corporation., (612) 221-1190.

E Peat Moss:

1. Type: Finely shredded, brown in color, suitable for horticultural purposes and frequently referred to in the trade as "greenhouse" or "coarse grind".
2. Measurement: Measure peat in air-dry condition, containing not more than 35% moisture by weight on an "as-received" basis. Ash content not to exceed 10%.
3. Physical Properties:

| Percent Passing | Sieve Size                |
|-----------------|---------------------------|
| 95-100          | 9.51 mm (3/8 in.)         |
| 0- 40           | 500 micron (#35, 32 mesh) |
4. Organic Content (dry weight basis): 90-100%.



5. Chemical Properties:

Nitrogen (dry weight basis): 0.6-3.0%

Soluble Salts/Salinity (Saturation Extract Conductivity): Maximum  
3.0 millimhos/cm at 25 degrees C.

pH: 3.0-4.5

F Pre-plant Fertilizer: See Soil Preparation - Section 02920

G Top-Dress Fertilizer: 16-6-8 (N-P-K) Planting - Section 02950.

H Hydroseed Fertilizer: Gro-Power 12-8-8 slow release.

2.07 HYDROSEEDING EQUIPMENT

A Type: Commercial hydro-seeder with built-in agitation system and an operating capacity sufficient to agitate, suspend and homogeneously mix slurry.

B Distribution Lines: Sufficient to prevent stoppage and provide even distribution of the slurry over the ground.

C Pump Capacity: 150 psi at the nozzle.

D Slurry Tank: 1,000 gallons minimum capacity.

2.08 HYDROSEED MIXES

A Submit mix design from supplier. For Bid assume the following Hydroseeding Mix Per Acre:

2000 lbs. Mulch

80 lbs. Tackifier

Seed Mix as per seed schedule.

150 lbs. Incorporated Fertilizer

PART 3 - EXECUTION

3.01 EXAMINATION

A Verification of Conditions:

1. Grades: Verify that grades are within 2 inches plus or minus of the required finished grades. Verify that fertilization and erosion control

materials have been installed per other sections. Report all variations in writing.

2. Stones, Weeds, Debris: Verify that all areas are clear of stones larger than 3/4" in. diameter, weeds, debris and other extraneous materials.

### 3.02 PREPARATION

#### A HYDROSEED AREA:

- 1 Refer to "Soil Preparation" Section 02910 and "Finish Grading" Section 02310 for soil preparation and grading.
- 2 Apply non-specific, broad spectrum, short duration herbicide at rates recommended by manufacturer for pre-seed weed treatment.
- 3 Pre-Plant Fertilizer: 16-20-0, 5-6 lbs per 1000 sq. ft. The fertilizer should be lightly raked into the soil prior to sodding.

#### B SOD AREA:

- 1 Refer to "Soil Preparation" Section 02910 and "Finish Grading" Section 02310 for soil preparation and grading.
- 2 Pre-Plant Fertilizer: A high phosphate and potassium fertilizer 4-10-10 or 6-20-20 applied at 5 lbs. per 1000 square feet of turf area will enhance root establishment. The fertilizer should be lightly raked into the soil prior to sodding.

C Excessive Soil Moisture: Do not commence work of this section when soil moisture content is so great that excessive compaction will occur.

D Inadequate Soil Moisture: Apply water, as necessary, to bring soil to an optimum moisture content for planting. Do not work soil when it is so dry that dust will form in air or that clods will not break readily.

### 3.03 HYDROSEED GRASS

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
3. Hydromulch shall be cleaned off all structures, fences, walks, paved areas, and the like, immediately after operations are completed.
4. Irrigate within 12 hours of seed application and maintain moist but not saturated condition, obtaining moisture penetration to a minimum of 2" soil depth.

### 3.04 SODDED LAWN INSTALLATION

#### A Sod Bed Preparation:

1. Rolling: Roll amended soil with 200-pound water-ballast roller.
2. Moistening: After all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.
3. Timing: Sod immediately thereafter, provided the sod bed has remained in friable condition.

#### B Sodding Operations:

1. Starter Strip: Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other. Stagger lateral joints. Do not stretch or overlap sod. Butt all joints tightly to eliminate all voids.
2. Cutting: Use a sharp knife to cut sod to fit curves.
3. Tamping and Rolling: Thoroughly tamp and roll sod to make contact with sod bed. Roll each entire section of completed sod.
5. Watering: Start watering immediately after first strips of sod is installed. Thoroughly soak sod, and then roll the sod to smooth out bumps and air pockets. Water frequently for the first 10-14 days; use enough water to saturate soil to a depth of 4".
6. Top-Dress Fertilizer: Apply at the rate of (6) to (8) pounds per 1,000 square feet at 25 days and at 50 days after sodding.

### 3.05 FIELD QUALITY CONTROL

- A Tests: Samples of materials may be taken and tested for conformity to Specifications at any time.
- B Rejected Materials: Remove rejected materials immediately from the site at Contractor's expense. Pay cost of testing of materials not meeting Specifications.

### 3.06 CLEANING

- A Hydroseed Overspray: Immediately after application, thoroughly wash off slurry from all materials, and areas not designated to receive slurry mix.
- B Erosion: Immediately restore eroded areas. Keep all adjacent paved surfaces cleaned of dirt, mud or stains and organic debris.

END OF SECTION

## SECTION 02930

### PLANTING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A Work Included: Provide planting complete, as shown and as specified.

1. Trees
2. Shrubs.
3. Annuals, Perennials, Groundcovers
4. Liners, Plugs, live stakes.
5. Landscape edging.
6. Planting Accessories.
7. Mulches.
8. Tree well drainage.
9. Filter fabric.
10. Rip Rap at top of slope drain outlets.
11. Granite Rip Rap Splashblock at vegetated swale flow spreader.

B Work Specified Elsewhere:

1. Earthwork: Section 02200
2. Soil Preparation: Section 02910
3. Irrigation System: Section 02810
4. Lawns and Grasses: Section 02920
5. Landscape Maintenance: Section 02935

##### 1.2 REFERENCES

- A "An Annotated Checklist of Woody Ornamental Plants of California, Oregon and Washington, (Number 4091)", McClintock and Leiser, Division of Agricultural Sciences, University of California, 1979.
- B "American Standard for Nursery Stock", 1986 Edition, American Association of Nurserymen, Inc.
- C "Hortus III", 1976 Edition, Bailey Hortorium, Cornell University.

##### 1.3 DEFINITIONS

A. General Nomenclature: as suggested by ANSI Z60.1

- B. Balled and Burlapped (B&B) Stock: Trees dug with firm, natural balls of earth in which they are grown, wrapped in burlap and/or wire. B&B trees held long enough for new roots to begin to grow through the burlap are “heeled-in” or “cured”.
- C. Balled and Potted Stock: Trees dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container.
- D. Bare-Root Stock: Trees with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed.
- E. Clear Trunk or Branching Height: The portion of the lower trunk maintained free of any branches measured from the top of root ball to the underside of the first lowest permanent branch.
- F. Container-Grown Stock: Healthy, vigorous, well-rooted trees grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container.
- G. Crown Spread or Diameter: the average diameter of the widest portion of the crown and that diameter perpendicular to it.
- H. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted trees established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag.
- I. Included Bark: Bark between a branch and trunk or between trunks that is squeezed together in the crotch of the branch resulting in a weak branch union.
- J. Root Ball Diameter: The average diameter of the widest portion of the root ball and that diameter measured perpendicular to it.
- K. Trunk Wound: A trunk injury that is open and not callused over. A properly executed pruning cut that has yet to close over is not considered a trunk wound.
- L. Finish Grade: Elevation of finished surface of planting soil.

#### 1.4 MEASUREMENT & GRADING

- A. Time: The specified sizes and grades shall be at the time of delivery to site. Any assessment or measurement before this time can only be based on the plant characteristics at that time and not any future or predicted growth potential of the plant.
- B. Size: The measurements specified or referenced shall be the minimum sizes acceptable after any necessary pruning and with branches, trunks or canes in their normal position. Plants that meet measurements specified but do not

possess a normal balance between height and spread shall be rejected. Plants larger than specified may be used if approved by the Landscape Architect. Use of such plants shall not increase the Contract price. If larger plants are approved, increase the planting pit in proportion to the size of the plant.

## 1.5 SUBMITTALS

- A Product Data: Manufacturer's current catalog cuts and specifications of the following:
1. Mulch and fertilizer tablets.
  2. Tree staking.
  3. Anti-desiccant.
- B Samples:
1. Mulches: One (1) pint, each type.
  2. Header and Edge material(s)
  3. Small rip rap granite: Samples shall indicate variation in color, texture and hardness.
- C Photographs: Submit images within fourteen days of proposed field inspections of each plant species of each size clearly showing the full range of variations.
1. Format: Digital high resolution jpeg file.
  2. Scale: Include a yardstick in each photograph to provide scale.
  3. Background: Ensure form and condition of plant is clear from background.
  4. Identification: On the back of each print and/or as an email attachment, provide the following information:
    - a. Name of Project & Owner.
    - b. Name & address of grower.
    - c. Date photograph was taken.
    - d. Species name and quality grade.
- D Certificates of Inspection: As required by law for transportation of each shipment of plants along with invoice.
- E Supply Problems & Substitutions: Submit immediate notice of any supply difficulties and substantiate if any material specified is not obtainable including copies of supplier's correspondence. Submit in writing to the Owner's Representative no later than twenty-one days after the Notice to Proceed any proposed plant alternatives or substitutions of equivalent size and/or variety with corresponding adjustment of Contract Price. Alternatives shall not be considered after this time.
- F Nursery Reviews: Submit written requests for review of plants at the nursery/plantation. Give a minimum of twenty-one days' (21) notice of review.

State the names and addresses of the nursery/plantation and quantity of plants to be reviewed.

- G Submit preferred location of First Install for each planting area type.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
1. Sourcing: Require an experienced plant finder whose work has resulted in successful sourcing, selection and delivery of quality plants. Hire a plant broker if necessary.
  2. Delivery Supervision: Require an experienced person who can assess the condition of the plants at the time of loading and unloading and who can resolve any disputes on site.
  3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.
- B. Observation: Plants may be subject to review both at the nursery/plantation and at the delivery site for conformity. Such acceptance shall not impair the right of review and rejection during progress of the Work. Owner's Representative reserves the right to refuse the review if, in the Landscape Architect's opinion, a sufficient quantity of plants are not available. Plants specified in 24" box and larger shall be reviewed and tagged at place of growth by the Landscape Architect at their discretion.
1. Notify Landscape Architect of sources of plants fourteen days in advance of delivery to site.
  2. Notify Landscape Architect when lay out of plants is ready for review fourteen days in advance of delivery to site.
- C. Ordering: Be responsible for searching, locating and ordering natural materials with long lead times and/or seasonal dependencies. No extensions of time or variations shall be considered if supply is compromised by late sourcing and/or ordering.
- D. Allowance for losses: Grow additional plants to ensure that the contract quantities shall be achieved after normal production losses from natural causes, breakage, natural random non-conformities, transplant shock and/or delivery damage. Replace any plants that are damaged, fail or are rejected.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."



- F. Subcontract fabrication and installation of rip rap materials to a firm or firms which have successfully fabricated work of similar quality and schedule requirements, and in the quantity shown, for a period of not less than 3 years.
1. Installer must review installation procedures and sequence with Construction Manager to insure proper coordination with other subcontractors and suppliers whose work is affected by the delivery schedule and installation of rip rap work.
  2. First Install: First installation shall be completed to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
    - a. The extent and location of first installations shall be submitted for approval.
    - b. First installations shall be protected and incorporated in the completed work.
    - c. Approval of first installation is for placement, texture, and overall shaping of rock surface.

#### 1.7 SEQUENCING AND SCHEDULING

- A Acceptance: Do not install plant materials prior to acceptance of soil preparation, drain pit testing, finish grades and main line trenching/installation of irrigation system.
- B Coordination: Coordinate with work of other sections to insure the following sequence of events:
1. General: Irrigation system to be installed and operable prior to installation of plant materials. Schedule hand watering of all plant materials installed prior to sprinkler irrigation system.
  2. Headers and Landscape Edging: Install prior to installation of adjacent sprinkler irrigation system.
  3. Trees in Tree Grates at Concrete Paving: As necessary, install prior to installation of paving under another Section. See Drawings.
  4. Pruning: Do not prune plant materials prior to installation and acceptance. Request review by Landscape Architect prior to any pruning.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A Delivery: Do not deliver disease-infected plant materials to the site .
  - 1. Notification: Notify Owner at least two (2) weeks in advance of date when plants will be picked up and transported to the place of installation.
  - 2. Inspection: Inspect plants prior to acceptance and notify Landscape Architect of all unacceptable plants. Pick up of plants shall constitute acceptance for the purpose of warranties.
- B Labeling: Furnish standard products in manufacturer's standard containers bearing original labels legibly showing quantity, analysis, genus/species and name of manufacturer/grower.
- C Storage: Keep plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.
- D Handling: Do not lift or handle plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.
- E Anti-Desiccant: At Contractor's option, immediately before transporting, spray deciduous plant materials in full leaf or evergreens with anti-desiccant. Apply an adequate film over trunks, branches, twigs and foliage.
- F Digging: Dig B & B plants with firm, natural balls of earth of diameter not less than that recommended by USDA Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. Wrap and tie as required to prevent all cracking or loss of soil from rootball

## 1.9 WARRANTY

- A Warrant that all plants planted under this Contract will be healthy and in flourishing condition of active growth one (1) year from date of Final Acceptance. Similarly warrant groundcover and grasses for a period of six (6) months from date of Final Acceptance.
- B Correct Species: Warrant that all plant materials are true to species and variety.
- C Delays: Delays caused by the Contractor in completing planting operations, which extend the planting into more than one planting season, shall extend the Warranty Period correspondingly.
- D Condition of Plants: Plants shall be free of dead or dying branches and branch tips, with foliage of normal density, size and color.
- E Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving

condition, as determined by Landscape Architect during and at the end of Warranty Period.

- F Exclusions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, and acts of Nature, during Warranty Period. Report such conditions.

1.10 MAINTENANCE PERIOD AND FINAL ACCEPTANCE: See Section 02970 - Landscape Maintenance

1.11 REPLACEMENTS

A Failed Materials:

1. Repair and/or replace at no cost to the Owner all plant materials exhibiting conditions which are determined as unacceptable due to workmanship by the Contractor.
2. Closely match replacements to adjacent specimens of the same species. Apply requirements of this Specification to replacements.
3. Contractor shall be held responsible for a maximum of two (2) replacements for each failed tree, shrub and vine, and same area of groundcover planting after final acceptance during warranty period.

B Incorrect Materials:

1. During Warranty Period, replace at no cost to Owner plants revealed as being untrue to name and species.
2. Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

PART 2 - PRODUCTS

2.1 PLANTS

- A Plant Materials: Verify that all container stock (excluding annuals) has been grown in the containers in which delivered for at least one growing season, but not over two (2) years.
1. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of the project for at least two years unless otherwise specifically authorized.
  2. Appearance: Trees shall be exceptionally heavy, symmetrical, tightly knit, and so trained or favored in development and appearance as to be superior in form for their species, with regard to number of branches, compactness and symmetry.

3. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions that would prevent thriving growth.
- B Requirements: Provide quality, size, genus, species, variety and sex of plants indicated conforming with the Plant Schedule and which;
1. Are fit for purpose.
  2. Are acclimated to the proposed site conditions.
  3. Have an optimum habit and sound, healthy, vigorous growth without excessive succulence.
  4. Comply with the requirements of ANSI Z60.1.
  5. Have a normal amount of flowers, fruit, cones, and seeds.
  6. Sturdy root ball when trunk bends along its vertical length and no pivoting at the base or moving the root ball.
  7. A symmetrical/radial pattern of well-branched fibrous roots without crushed/torn ends.
  8. Have no weeds.
- C Condition of Root System: Samples must prove to be completely free of circling, kinked or girdling trunk surface and center roots and show no evidence of a pot-bound condition. Upon inspection by Landscape Architect at the job site, if five (5) percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species from that source will be rejected.
- D Measurements:
1. General: Take caliper measurement at a point on the trunk 6 in. above natural ground line for trees up to 4 in. in caliper and at a point 12 in. above the natural ground line for trees over 4 in. in caliper.
    - a. Measure foliage across mean foliage dimension when branches are in their normal upright position. Foliage origin along main trunk shall be measured from soil line.
    - b. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.
  2. Size Range: If a range of size is given, do not use plant materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

3. Batching: Select, grade and blend plants into batches appropriate to their final arrangement on site and delivery sequence. For formal arrangements, rows, allees, hedges and/or bosques group plants in batches so that within each batch,

Trees shall only vary in;  
Height less than 1 foot  
Spread less than 2 feet  
Clear trunk/branching height less than 6 inches.

Shrubs shall only vary in;  
Height less than 10 inches  
Spread less than 10 inches

- E Substitutions: Substituted plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted. Use of such plants shall not increase Contract price. If larger plants are accepted, increase the ball of earth in proportion to the size of the plant. Plants overgrown for their container size will be rejected.
- F Unacceptable Trees: Trees that have damaged or crooked leaders, will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused, will be rejected.
- G Pruning: Do not prune plants before delivery. Consult Landscape Architect for pruning after installation.

## 2.2 SOURCE QUALITY CONTROL

- A Review: Submit a written request for review of plant materials and quantity at place of growth at least sixty (60) calendar day's prior to shipment to site. Right is reserved to refuse review at this time if, in his judgment, a sufficient quantity of plants is not available.
- B Transportation: Contractor shall accompany Landscape Architect to all review(s) of plant materials at the nursery. Landscape Architect will review and tag plants at place of growth and upon delivery for conformity to specifications.
- C Distant Material: Submit photographs with a person adjacent to each plant type for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.
- D Unavailable Material: If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.

- E Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

## 2.3 ALTERNATIVE MATERIALS

- A All proposed plant, material, or product substitutions shall be subject to approval by Owners Representative.

## 2.4 PLANTING SOIL MIXES

- A. Backfill Mix for Plant Pits: See Section 02910 - Soil Preparation.
- B. Vegetated Swale Soil Mix: See Section 02325 – Swale Bioretention Soil and Check Dams.
- C. Structural Planting Soil: See Section 02320 – Structural Soil.

## 2.5 MISCELLANEOUS PRODUCTS

- A. Tree Stakes:

1. “Grate Stake” by Reddy Stake for tree installed in tree grates as manufactured and distributed by J.R. Partners (888) 333-3090, Install 2 per tree. <http://www.jrpartnersco.com>.
2. Lodgepole Stakes: 2” diameter, 8 ft. length. Install 3 per tree; or Galvanized steel stakes: 12 ft length. Install 3 per tree.
3. Install per details and manufacturers recommendation.

- B. Bark Mulch:

Composted pine or fir bark or ‘Tree In-Carnation Premium Mulch’ Green Waste Recycling Yard in Richmond, CA Tel. 510.527.8733 or approved equal. Size: ½ in. to 1in. diameter.

- C. Gravel mulch at Vegetated Swale:

1. Crushed Granite Mulch: 1/2” minimum size with no fines, American Soil Projects, 2121 San Joaquin, Richmond, CA. 510.292.3000
2. Crushed Granite Mulch: 1/2” minimum size with no fines, Lyngso Garden Supply, 19 Seaport Blvd. Redwood City, CA (650) 364-1730 or equal.
3. Pea Gravel: 1/2” pea gravel, dark gray color.

- D. Steel Landscape Edge: 3/16" x 4" x 16' steel landscape edge, powder coated black, with interlocking system and stake punch outs fabricated in each strip and 12" steel stakes.

Sure-loc Corporation, 494 E. 64th Street, Holland, Mi 49423 1-800-787-3562 or equal.

- E. Tree wells: See Drawings.

- F. Water:

1. Clean, fresh and potable.
2. Transport as required.

- G. Anti-Desiccant/transpirant:

1. Type: Sprayable, water-soluble pine oil complex that will produce a moisture-retarding barrier not removable by rain (or snow).
2. Product: "Wilt-Pruf" by Wilt-Pruf Products, Inc., Greenwich, CT.

- H. Filter Fabric:

1. Non-Woven Filter Fabric (8 ounce) such as Mirafi 180N, or equivalent. Staple according to manufacturer's recommendations.
2. Erosion Control Blanket S150, as manufactured by North American Green, Evansville, IN 47711, (812) 867-6632 or equal. Staple according to manufacturer's recommendations.

- I. Tree Grates: Refer to "Site Furniture" Section 02870.

- J. Small granite rip rap

1. Color / Product: Dk. Grey Granite angular rip rap
2. Size: Minimum dimension 4" x 6" to maximum dimension 6" x 8"

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A Verification of Conditions:

1. Finish Grades: Finish grades for planting areas shall have been established in another Section. Verify that all grades are within 1 in. plus or minus of required finish grade.
2. Soil Preparation: Do not commence planting work prior to completion and acceptance of soil preparation.

3. Irrigation: Verify that irrigation system has been installed and accepted prior to planting.

### 3.2 PREPARATION

- A Layout and Staking: Layout plants at locations shown on Drawings. Stake each tree. Outline shrub and groundcover beds with lime.
- B Review: Locations of plants will be checked in the field and will be adjusted to exact position before planting begins. Right is reserved to refuse review at this time if, in the Landscape Architect's opinion, an insufficient quantity of plants is available.
- C Digging Plant Pits: Dig tree pits and scarify all sides of the tree pit after excavation - see below. Do not use an auger or tree spade.
- D Containerized Plant Pits: Excavate planting holes as detailed to dimensions dictated by the root ball dimensions.

### 3.3 DRAINAGE TEST OF TREE PLANTING PITS

- A Representative tree pits shall be tested to verify adequate drainage. Pending drainage test results, drainage may be required at tree pits.

Minimum number to be tested shall be one [1] pit per every ten [10] pits. Pit locations to be verified by Landscape Architect.

1. Auger a 12" diameter x 10" deep hole in the bottom of a sample tree pit. Fill with 10 inches of water [1]. Allow to drain. If pit does not drain, note on written documentation.
2. Fill test drain hole again with 10 inches of water again [2]. Document percolation every hour.
3. Legibly calibrate a stake at 1 in. intervals and drive it firmly into the undisturbed soil at the bottom of the hole.
4. Fill the 10 inch hole with water to the top. Immediately record water level on the stake.
5. Document water level every hour for the first 8 hours.
6. Document amount of standing water at end of 20 hours.
7. Do not perform test on a rainy day. Repeat all tests interrupted by rain or cold.
8. Verify locations of adjacent utilities prior to auguring drain pit hole.
9. Documentation: Submit written documentation of all test pits results, dated and signed by the tester.

- B Correction: Submit for acceptance a written proposal and cost estimate for the correction of poor drainage conditions before proceeding with planting.



- C Obstructions: If rock, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits, acceptable alternate locations may be used at direction of Landscape Architect.
  - D. Tree drainage required at trees in tree grates. See Drawings.
- 3.4 HEADERS AND EDGES: Lay out locations of headers for review prior to final installation. Install per details in Drawings true to line and grade.
- 3.5 TREE, SHRUB AND VINE PLANTING
- A Handling and De-potting of Plant Materials:
    - 1. Damage: Avoid damage to containers and rootballs. If rootball is cracked or broken during handling and de-potting, plant will be rejected. Do not remove plant from container prior to completion of plant pit preparation.
    - 2. Canned Trees and Shrubs: Plastic Containers: Tip container to horizontal orientation and shake carefully to remove shrub. Support rootball during installation to prevent cracking or shedding of soil.
    - 3. Boxed Trees: Lift from bottom with forklift or from sides with 2 in. x 4 in. rails nailed to each side of box. Do not remove box prior to settling tree in plant pit. Remove sides of box after acceptance by Landscape Architect and prior to backfilling.
  - B Installation:
    - 1. Scarification:
      - a. Plant Rootball: After removing plant from container, scarify the sides of the rootball to a depth of 1 in. at four to six equally-spaced locations around the perimeter of the ball or at 12 in. intervals on sides of boxed materials. Cut and remove circling roots over 3/8 in. diameter.
      - b. Plant Pit: Scarify sides of plant pit, thoroughly breaking up surfaces and eliminating "glazed" areas.
    - 2. Positioning: Backfill plant pit to allow setting crown of tree 3-6 in. above new finish grade and crown of shrub 1 in. above finish grade. Thoroughly foot tamp all backfill. Position plant in planting pit, maintaining plumb condition. Maintain throughout all planting operations.
    - 3. Backfilling:

- a. Use backfill mix to backfill plant pits as shown on Drawings. Brace each plant plumb and rigidly in position until planting soil has been tamped solidly around the ball and roots.
  - b. When plant pits have been backfilled approximately 2/3 full, water thoroughly and saturate rootball, before installing remainder of the backfill mix to top of pit, eliminating all air pockets.
- 4. Staking: Stake as specified below.
- C Watering Basin: Form saucer with 3 in. high berm centered around tree and shrub pits 12 in. wider than ball diameter.
- D Watering: Immediately water all plants after completion of planting operations.

### 3.6 STAKING

- A General:
  - 1. All Trees shall be staked as shown on drawings. Care must be taken to properly align stake with prevailing wind direction.
  - 2. Remove nursery stakes.
  - 3. Trees shall be able to stand upright without support, and shall return to the vertical after their tops have been deflected horizontally and released.
  - 4. Trees shall remain plumb and straight from installation through the warranty period.
  - 5. Insure tree branches do not rub against tree stakes.
  - 6. Supplemental tree support, if required, shall be done without additional cost to the Owner.
- B Installation:
  - 1. Locate stakes as detailed in the Drawings.

### 3.7 PRUNING: See Section 02970 - Landscape Maintenance.

### 3.8 MULCHING

- A Install a 2 inch deep layer of mulch over all shrub areas including tree and shrub watering basins.
- B Keep base of trunk clear of mulch.

C Unless otherwise shown on Drawings mulch surfaces shall finish 1/2" below edge of adjoining paving and 1/2" below tops of walls.

D Rake surface smooth and free from clumps.

### 3.9 GRANITE RIP RAP AT SPLASHBLOCK

A Place Rip Rap and filter fabric as shown on drawings.

### 3.10 CLEANUP AND PROTECTION

A Keep adjacent paving and construction clean and work area in an orderly condition.

B Protect plants from damage due to landscape operations, and operations by others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plants

### 3.11 DISPOSAL

A Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

## SECTION 02935

### LANDSCAPE MAINTENANCE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A Work Included: Provide continuous Landscape Maintenance, complete as specified during progress of the work, after installation, and for a minimum period of 180 days after Preliminary Acceptance, and as required by warranty and part 3.09, Termination of the Maintenance Period.
- B Work Specified Elsewhere:
  - 1. Earthwork: Section 02300
  - 2. Soil Preparation: Section 02910
  - 3. Irrigation: Section 02810
  - 4. Lawns and Grasses: Section 02920
  - 5. Planting Section: 02930

##### 1.02 REFERENCES

- A University of California Cooperative Extension Publications:
  - "Fertilizing Woody Plants", Leaflet #2958, Sept. 1979.
  - "Pruning Landscape Trees", Leaflet #2574, Jan. 1979.
- B "Arboriculture: Care of Trees, Shrubs and Vines in the Landscape" by Richard W. Harris, Prentice-Hall, Inc. 1983.

##### 1.03 SUBMITTALS

- A Quality Control Submittals:
  - 1. Schedule of maintenance operations and monthly status report including irrigation schedules, list of equipment, materials proposed for the job.
  - 2. Licenses, permits and insurances required by the County, the State or Federal government pertaining to maintenance work.
  - 3. Monthly record of all herbicides, insecticides and disease control chemicals used for the project.
  - 4. Schedule of recommended annual fertilizer and soil conditioning program provided by Soils Testing Lab based on plant schedule.
- B Project Close-out Submittal: Include in a single, 3-ring binder a landscape maintenance manual containing an indexed collection of all schedules, records

and permits listed above, as well as a documentation of accepted condition of planting and irrigation at Final Acceptance.

#### 1.04 QUALITY ASSURANCE

##### A Qualifications:

1. Experience: The landscape contractor or maintenance subcontractor shall have a full-time employee assigned to the job as foreman for the duration of the contract. He/she shall have a minimum of ten years experience in landscape maintenance supervision, with experience or training in turf management, entomology, pest control, soils, fertilizers and plant identification.
2. Labor Force: The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to the Landscape Architect.

##### B Requirements:

1. Supervision: The foreman shall directly supervise the work force at all times. Notify Landscape Architect of all changes in supervision.
2. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner.

#### 1.05 PROJECT/SITE CONDITIONS

- A Site Visit: At beginning of maintenance period, visit and walk the site with the Landscape Architect to clarify scope of work and understand existing project/site conditions.
- B Documentation of Conditions: Document general condition of existing trees, shrubs, vines, groundcovers and lawn recording all plant materials which are healthy, thriving, damaged, dead or dying.
- C Irrigation System: Document general condition of existing irrigation system, making sure that faulty electrical controllers, broken or inoperable sprinkler heads or emitters are reported.
- D Include above documents in maintenance manual binder and submit to Owner.

#### 1.06 SEQUENCING AND SCHEDULING

- A Perform all maintenance during hours mutually agreed upon between Owner and Contractor.

- B Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance schedule.

#### 1.07 WARRANTY

- A Specific Requirements: Refer to the following sections:

1. Lawns and Grasses – Section 02920
2. Planting - Section 02930.
3. Irrigation – Section 02810

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A General: All materials and equipment shall be provided by the Contractor, except as specified below.
- B Water: Clean, potable and fresh, as available from Owner
- C Fertilizers:
  1. Tightly-compressed, slow-release and long-lasting complete fertilizer tablets bearing manufacturer's label of guaranteed analysis of chemicals present.
  2. Balanced, once-a-season application, controlled-release fertilizers with a blend of coated pills which supply controlled-release nitrogen, phosphorus and potassium, and uncoated, rapidly soluble pills containing nitrogen and phosphorus.
- D Herbicides, Insecticides, and Fungicides:
  1. Best quality materials with original manufacturers' containers, properly labeled with guaranteed analysis.
  2. Use non-staining materials.
- E Replacement Tree Stakes and Ties: Match originally accepted existing materials on the site.

#### 2.02 EQUIPMENT

- A General: Use only the proper tool for each job. Maintain all tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage and between each tree and shrub to be pruned.
- B Insect/Disease Prevention: Take all acceptable measures to prevent introduction of insect or disease-laden materials onto the site.

## PART 3 - EXECUTION

### 3.01 ESTABLISHING THE MAINTENANCE PERIOD

- A Preliminary Review: As soon as planting is substantially completed per documents, hold a preliminary review to determine the condition of the work.
- B Date of Review: Notify Landscape Architect at least five (5) working days prior to anticipated date of review.
- C Beginning of the Maintenance Period: The date on which the Landscape Architect issues a letter of Preliminary Acceptance to the Contractor.

### 3.02 PREPARATION

- A Protection:
  - 1. Protect all new planting areas from damage of all kinds from beginning of work until sufficiently established or until Final Acceptance.
  - 2. Provide temporary protection fences, barriers and signs as required for protection.
- B Replacements:
  - 1. Immediately treat or replace all plants, which become damaged or injured as a result of Contractor's operations or negligence, as, directed by Landscape Architect, at no cost to Owner.
  - 2. Replacement plants shall match size, condition and variety of other similar plants at time of replacement.

### 3.03 PLANTING

- A Watering Basins:
  - 1. For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.
  - 2. Maintain originally called for depth of mulch to reduce evaporation and frequency of watering.
  - 3. In rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.

- B     Resetting: Reset plants to proper grades and upright position.
- C     Weed Control:
1.     All areas between plants, including watering basins and including lawn areas, shall be free of weeds greater than ½" tall, and all invasive grasses at all times.
  2.     Use only recommended and legally approved herbicides to control weed growth.
  3.     Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.
- D     Pruning:
1.     Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay one another.
  2.     Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Reduce toppling and wind damage by thinning out crowns.
  3.     Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.
  4.     No stripping of lower branches ("raising up") of young trees will be permitted.
  5.     Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth (tapered trunk). Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.
  6.     Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.
  7.     Prune damaged trees or those that constitute health or safety hazards at any time of year as required.
  8.     Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.



9. Branches too heavy to handle shall be precut in three stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.
10. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.
12. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to all other plants.

E Staking and Guying of Trees:

1. Inspect stakes at least once a month to check for rubbing that causes bark wounds.

### 3.04 HYDROSEED AREAS

A Watering:

1. Check for moisture penetration throughout the root zone at least twice a month.

B Weed Control:

1. Control weeds, preferably with pre-emergent herbicides and with selective systemic herbicides.
2. After the grasses have grown beyond the 3-leaf stage, spray a broad-leaf herbicide to eliminate any weeds that germinate after pre-plant preparation. Apply herbicide at low label rates as per manufacturer's recommendations. If necessary a follow up application 4 to 6 weeks later should eliminate most broadleaf weeds.
3. During the first growing season, mow as required to suppress annual weeds. The cutting height should be 4 to 5 inches. Mow each time the weed growth is 6 to 10 inches high, and do not allow weeds to set seed. Mow frequently so cuttings are not large enough to smother native seedlings. Time the last mowing so weeds can grow to about 8 inches before winter.

C Fertilization:

1. Verify specific plant requirements, if any.
2. Recently installed plant materials: Verify with Owner actual completion date of planting installation and rate of prior application of fertilizers.

### 3.05 GROUNDCOVERS

#### A Watering:

1. Check for moisture penetration throughout the root zone at least twice a month.
2. Water as frequently as necessary to maintain healthy growth of groundcovers.

#### B Weed Control:

1. Control weeds, preferably with pre-emergent herbicides and with selective systemic herbicides.
2. Minimize hoeing of weeds in order to avoid plant damage.

#### C Fertilization:

1. Verify specific plant requirements, if any.
2. Recently installed plant materials: Verify with Owner actual completion date of planting installation and rate of prior application of fertilizers.
2. New plant materials: Place one (1) 5-gram tablets (20-10-5; N-P-K) beside the root ball about an inch from root tips.
3. Established Plant Materials: Do not use complete fertilizers unless soil test shows specific nutrient deficiencies.

#### D Mowing and Edging:

1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.
2. Groundcovers, which lend themselves to mowing, shall be mowed to specified height above finished grade in order to renew growth, improve density and attractiveness.

#### E Replace dead and missing plants after obtaining Owner's agreement to pay for replacement. Damages due to Contractor's negligence shall be paid for without charge to Owner.

### 3.06 ANNUALS AND PERENNIALS

#### A. Watering:

1. Species, sizes of plants, container sizes and orientation shall dictate frequency of watering. Submit to Owner a watering schedule for different seasonal requirements.

- B. Weed Control: All planters with annuals and perennials shall be weed-free at all times.
- C. Pruning:
  - 1. Limit pruning to removal of damaged or dead twigs and foliage.
  - 2. Remove spent flowers on a weekly basis.
- D. Fertilization: Incorporate slow release fertilizers per manufacturer's current specifications, and rake smooth.

### 3.07 INSECTS, PESTS, AND DISEASE CONTROL

- A Inspection: Inspect all plant materials for signs of stress, damage and potential trouble from the following:
  - 1. Presence of insects, moles, gophers, ground squirrels, snails and slugs in planting areas.
  - 2. Discolored or blotching leaves or needles.
  - 3. Unusually light green or yellowish green color inconsistent with normal green color of leaves.
- B Personnel: Only licensed, qualified, trained personnel shall perform spraying for insect, pest and disease control
- C Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.

### 3.08 IRRIGATION SYSTEM

- A General:
  - 1. Repair without additional charge to Owner all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.
  - 2. Report promptly to Owner all accidental damage not resulting from Contractor's negligence or operations.
  - 3. Set and program automatic controllers for seasonal water requirements.
  - 4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.
- B Cleaning and Monitoring the System:

1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.
2. Clear irrigation systems once a year and as often as necessary to keep the irrigation systems free of sand and other debris.
3. Prevent spraying on windows, building walls, (game courts) by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

### 3.09 TERMINATION OF THE MAINTENANCE PERIOD

#### A Final Acceptance Procedure:

1. Work will be accepted by the Landscape Architect upon satisfactory completion of all work, including maintenance period, but exclusive of replacement of materials under the Warranty Period.
2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.
3. Submit maintenance operations manual to Owner.

#### B Corrective Work:

1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.
2. Perform corrective work and materials replacement in accordance with the Drawings and Specifications, and shall be made by the Contractor at no cost to the Owner.
3. After corrective work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.
4. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

#### C Conditions for Acceptance of Work at End of Maintenance Period:

1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.
2. Replace all plants not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

- D Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, the Owner will assume responsibility for maintenance of the work.

### 3.10 CLEANING

- A Dispose of all pruned materials, vacuum all lawn clippings and leaves, sweep all walkways and rake smooth all mulched areas.
- B Remove from the site all containers and evidence of maintenance activities.

### 3.11 CLOSE OUT

- A Landscape Maintenance and Operations Manual: Submit binder to Owner with all documentation and records required and utilized during the maintenance period with recommended operations and maintenance procedures and schedules.
- B Keys and Identification: Return all keys and identification materials supplied by Owner for the purpose of site access.

END OF SECTION

## SECTION 02947

### VEHICULAR PLANT CELL PAVING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Work Included: Provide plant reinforcement complete as shown and as specified.
- B. Work Specified elsewhere:
  - 1. Earthwork: Section 02200
  - 2. Irrigation System: Section 02810
  - 3. Planting: Section 02930
  - 4. Soil Preparation: Section 02910
  - 5. Finish Grading: Section 02310

##### 1.3 SUBMITTALS

- A. Submit manufacturer's product data, installation section drawing for the specific applications, and installation instructions.
- B. Submit letter of certification regarding the products can accommodate H-20 traffic and fire truck loading.
- C. Submit a 10" x 10" section of Plant Cell paving material for review.
- D. Submit material certificates for base course and sand fill materials.

##### 1.4 PROJECT CONDITIONS

- A. Review installation procedures and coordinate plant cell paving work with other work affected. Generally, plant cell paving is installed at the same time as project planting installation, nearly the last site construction activity.

All hard surface paving adjacent to plant cell paving areas, including concrete walks and asphalt paving must be completed prior to installation of plant cell paving.

- B. Gradients for planted porous paving surfaces can vary from flat to 20%, depending upon vehicle types to use the surface. Please note that fire-lanes, or other emergency vehicles, will generally require a gradient that is less than 6%.
- C. Protect partially completed paving against damage from other construction traffic when work is in progress, and until root system has matured (about 3 to 4 weeks). Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.
- D. Protect adjacent work from damage during plant cell paving installation.

## 1.5 REFERENCES

- A. California Department of Transportation (CalTrans)
  - 1. Standard Specifications

## PART 2 - PRODUCTS

### 2.1 MATERIALS (In Order of Installation)

- A. Subgrade
  - 1. See Earthwork, Section 02200
- B. Permeable Base Course Material:
  - 1. Class II Permeable Material: See Section 02200 – Earthwork.
  - 2. Selected materials should be nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for plants at plant cell paving material.
- C. Bedding Layer:
  - 1. Sand: Clean sharp sand (washed masonry sand)
  - 2. Selected materials should be nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for plants.
- D. Hydrogrow mix:
  - 1. A mixture made from several commercial products including:
    - a. Cross-linked polyacrylimide (<0.1%) polymer, which is non-toxic and neutral in pH, and will absorb 150 to 350 times its weight in water from most tap sources;

- b. ZeoPro zeolite mineral, amended with small amounts of starter fertilizers, from Zeoconix, Inc.;
- c. Isolite porous ceramic, designed to hold large amounts of water without physical degradation or change of size of particle, from Sumitomo Group;
- d. Agglomerated Humate, a natural source of nutrients and micronutrients, from Tri-C Enterprises.

E. Plant Cell Paving Product

1. Plastic cellular structures

a. Requirements:

- 1) Lightweight injection-molded plastic cellular structural units, with hollow rings rising from a strong open grid, with interlocking features
- 2) Minimum unfilled (empty cell) compressive strength 250 psi.
- 3) Capable of handling H-20 Traffic Loading
- 4) Minimum 60% of root area at base unit to allow maximum grass root penetration and development
- 5) Minimum 95% post-consumer recycled reinforced high density Polyethylene (HDPE).
- 6) UV stabilized.
- 7) Chemical resistant

b. Manufacturers:

- 1) Turf Pave XD: Elmic, [www.elmich.com](http://www.elmich.com); Reed & Graham Inc. Geosynthetics, 1-888-381-0800, Sacramento, California
- 2) Grasspave2: Invisible Structures, Inc., [www.invisiblestructures.com](http://www.invisiblestructures.com), 1-800-233-1510, Aurora, Colorado
- 3) Or, approved equal.

2. Galvanized Steel anchors

- a. Galvanized steel staples or nails, 8" long, installed per Manufacturers recommendations.

F. Fill Material

- 1. Sand: Clean sharp sand (washed masonry sand)

G. Sod or rooted plants, see Drawings

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. It is recommended that inspectors be scheduled to inspect installation of plant cell paving during preparation of the subgrade, installation of the base course, and installation of plant cell paving units.



- B. Examine subgrade and base course installed conditions. Do not start plant cell paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.
- C. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Owner for resolution.

### 3.2 PREPARATION

- A. Prepare subgrade, base course, and bedding layer according to manufacturers' recommendations for the specific applications of plant cell paving products.
- B. Excavate site allowing for thickness of all materials. Grade subsoil, and compact the top six inches below subgrade to at least 95 percent maximum dry density.
- C. Place permeable base course material over prepared subgrade to grades shown on plans, in lifts not to exceed 6", compact each lift separately to 95% Modified Proctor.
- D. Install sand bedding layer on top of permeable base course, if applicable. Compact and level sand bedding layer.
- E. Spread all Hydrogrow mix provided evenly over the surface of the base course/ bedding layer with a hand-held, or wheeled, rotary spreader, at a rate of 5 lbs per 1000 ft<sup>2</sup>. The Hydrogrow mix should be placed immediately before installing the plant cell paving units to assure that the polymer does not become wet and expanded when installing the units.
- F. The level after spreading Hydrogrow mix should leave a minimum of 1" to 1.5" for plant cell paving unit, fill materials, and plants to Finish Grade.

### 3.3 PLANT CELL PAVING PRODUCTS INSTALLATION

- A. Install the plant cell paving units by placing units with rings facing up, and using metal anchors and holes provided to maintain proper spacing and interlock the units. Trim and cut plant cell paving units according to manufacturers' guides.
- B. Units placed shall be anchored to the base course, using 8" metal anchors or nails with fender washer, as required to secure units in place.
- C. Tops of rings shall be between 1-1/2" below the surface of adjacent hard-surface pavements.
- D. Install sandy fill material in rings as they are laid in sections by "backdumping" directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving over rings already filled with sand. The sand is then spread laterally from the

pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water sprayed evenly across the surface.

- E. Fill the plant cell paving units according to manufacturer's recommendations:
  - 1. The top of the plant cell paving units shall be covered with 0.5" of the sandy soil mix if the area is to be sodded, and by 0.75" if the area is to be planted with rooted plants, unless otherwise specified.

### 3.4 ROOTED PLANT INSTALLATION

- A. After rings have been filled with approved media, excavate cells by hand as required to receive rooted plants. Install rooted plants directly into rings, and backfill with approved soil media.
- B. See Drawing Planting Plan and Schedule for plant species and spacing.

### 3.5 PROTECTION AND MAINTENANCE

- A. Planted areas must be fertilized and kept moist during root establishment (minimum of 3 weeks).
- B. Planted areas must be protected from any traffic for a period of 3 to 4 weeks, or until the root system has penetrated and established well below the plant cell paving units.
- C. Maintain installation with normal plant maintenance (irrigate and fertilize).

### 3.6 CLEANING

- A. Remove and replace segments of plant cell paving units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.
- B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

END OF SECTION

SECTION 03100  
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnishing, installing and removing formwork for cast-in-place concrete, including form supports, and installation of embedded items.

1.2 INCLUDED WORK

- A. Section 02200 - Earthwork

1.3 RELATED WORK

- A. Section 03200 - Concrete Reinforcement
- B. Section 03300 - Cast-in-Place Concrete

1.4 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 318 – Building Code Requirements for Reinforced Concrete.
- C. ACI 347 – Recommended Practice for Concrete Formwork.
- D. PSI 83 – H.S. Product Standard for Construction and Industrial Plywood, H.S. Department of Commerce.

1.5 SUBMITTALS

- A. Submit formwork and coordination drawings.  
  
Formwork Drawings: Indicate pertinent dimensions, materials, bracing and reshoring, and arrangement of joints and ties.
- B. Product Data: Provide manufacturers' data and installation requirements on form materials, form coatings, form ties and other accessories.

1.6 QUALITY CONTROL

- A. Design formwork under direct supervision of an experienced designer of this work.
- B. Allowable tolerances shall be in accordance with requirements of ACI 347 unless otherwise noted in the Contract Documents.

## PART 2 – PRODUCTS

### 2.1 FORM MATERIALS

- A. Construct forms of sound material, straight and rigid, mortar-tight, and of the correct shape and dimensions. The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign materials.
- B. Form Materials for Exposed Surfaces: APA grade-stamped "B-B plyform, Class 1, Exterior" Douglas fir plywood; minimum 3/4" thick; each piece grade marked; clean, smooth, uniform in size and free of raised grain, torn surfaces, worn edges, patches or other defects; no mill oiling permitted.
- C. Form Materials for Unexposed Surfaces: Made of wood, metal, or other acceptable material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an acceptable type for the class of work involved and of the thickness and design required for rigid construction.
- D. Dimension Lumber: Douglas Fir, WCL1B No. 2 or better.
- E. Curved Surfaces: Form with metal, plywood, or adequately supported, surfaced and matched Douglas fir boards not more than 4" wide.
- F. Tubular Column Form: Round, spirally wound laminated materials, inside surface treated with release agent.
- G. Pole Foundation Form

### 2.2 FORM ACCESSORIES

- A. Form Ties: Metal, removable to a depth of at least 1" below the surface of the concrete. Ties shall be of sufficient strength to prevent the spreading of the forms during concrete placement. The use of wire ties will not be permitted.
- B. Form Coatings: Use an approved non-staining coating which will permit the ready release of forms and will not affect application of applied finishes. Form coatings containing mineral oils or petroleum solvents such as paraffin or other non-drying materials will not be permitted. Use specially formulated coatings for metal forms

to prevent rust stains on concrete.

## PART .3 – EXECUTION

### 3.1 PREPARATION

- A. Conform to considerations and recommendations in ACI 318, Chapter 6.
- B. Vertical and Horizontal Controls: Establish and maintain necessary benchmarks, lines, or controls throughout construction.
- C. Obtain necessary information and provide for openings, sleeves, chases, pipes, recesses, nailers, anchors, ties, inserts, and similar embedded items. Coordinate with concrete and other related work for requirements governing embedment and sleeving of pipes and conduit.
- D. Obtain approval from Engineer before framing openings not shown on the Drawings.

### 3.2 CONSTRUCTION OF FORMS

- A. General:
  - 1. Construct formwork to produce concrete surfaces conforming to tolerances in ACI 301. Construct formwork to the exact shapes, lines and dimensions of concrete members, arranged to allow erection in proper sequence and to permit removal without damage to concrete finish.

Unless otherwise indicated on Drawings, construct formwork panels in sections as large as practicable. Construct formwork of boards or plywood of same widths, shapes, and design for accurate location of form joints as indicated on the shop drawings. Fasten together with cleats; joists and studs may be used, at Contractor's option, in lieu of cleats if required for structural integrity of formwork. Verify clear space between forms to insure allowable coverage for reinforcing steel and allowable tolerances for construction.
- B. Framing and Bracing: Framing, bracing and supporting members shall be of ample size and strength to safely carry, without excessive deflection (exceeding allowable tolerances), all dead and live loads to which formwork may be subjected, and shall be placed sufficiently close to prevent any apparent bulging or sagging of forms.
- C. Exposed Concrete Surfaces:
  - 1. Make plywood panel patterns regular and symmetrical, joints plumb and

level, horizontal joints continuous. Control reuse of forms for exposed surfaces to provide surface of uniform color and texture without sharp demarcation between adjacent surfaces.

2. Average form ties for exposed concrete surfaces symmetrically. Align both vertically and horizontally (do not stagger).
  3. Edges of all form panels in contact with concrete shall be flush within 1/16" and flat surfaces shall be plane within 1/16" over any given meter span. Form joints shall be tight to prevent the passage of mortar, water and grout.
- D. Embedded Items: Secure all structural inserts, bolts, plates, and other embedded items. Use templates for equipment anchor bolts and other embedded items where final alignment is critical. Fill voids with readily removable material to prevent entry of concrete.
  - E. Waterproofing Conditions: Concrete surfaces to receive waterproofing and damp-proofing materials shall be formed to provide a relatively smooth surface free of sharp corners, projections, and offsets at construction joints. Form ties shall not penetrate or damage applied waterproofing and damp proofing.
  - F. Camber forms for slabs and beams as required to compensate for deflection of form members. Positive means of adjustment (wedges or jacks of shores and struts shall be provided to permit realignment or readjustment.
  - G. Forms for walls of considerable height shall be arranged with tremies and hoppers for placing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcements above the fresh concrete.
  - H. Provide temporary openings at bottom of forms where necessary to facilitate cleaning and inspection before concrete placement. Provide blockouts for mechanical and electrical work wherever necessary.
  - I. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
  - J. Construction joints and expansion joints shall be provided where indicated on the drawings.
  - K. Install cylindrical forms (i.e. Sono-tube or steel), which shall be left in place. Care must be taken to ensure that full support for the adjacent improvements are provided.

### 3.3 APPLICATION OF FORM COATINGS

- A. Thoroughly clean forms and coat with approved form coating material prior to initial use and before each reuse. Excess form coating material shall not stand in puddles in the forms nor shall such coating come in contact with hardened concrete against which fresh concrete is to be placed.
- B. Apply form coating material before reinforcing steel, anchoring devices and embedded items are placed and in strict accordance with manufacturer's directions.

### 3.4 FALSEWORK

- A. Contractor shall be fully responsible for proper strength, safety and adequacy of falsework, supports and bearing surfaces, which are used on and in connection with the work. Falsework shall be designed to support imposed loads without deformation, deflection or settlement.
- B. Wedges in pairs or jacks shall be used where required to maintain and/or adjust forms and formwork for beams, slabs and other parts of the structure at exact elevations. To ensure uniform bearing, single wedges are not permitted. Comply with requirements of ACI 347.
- C. Vertical and lateral loads shall be carried to ground by falsework system, or by the completed structure after it has attained the requisite strength. Falsework supports, when placed on ground, shall be protected against undermining or settlement.

### 3.5 REMOVAL OF FORMS AND FALSEWORK

- A. Responsibility: The sole responsibility for removal of forms/falsework and for any resulting structural or finish damage rests with the Contractor.
- B. The removal of forms and falsework shall be carried out in such manner as to ensure the complete safety of the structure. Supports shall not be removed until members have sufficient strength to safely support their own weight and all superimposed loadings:
- C. Unless otherwise specified the Drawings, the minimum time for forms to remain in place shall be:
  - 1. Side forms for footings, foundations, slabs on grade, or other components that do not resist bending shall not be removed in less than 48 hours after concrete placement. At times of low temperature or other adverse weather conditions, the Engineer may increase the required time to five days.

2. The falsework and forms supporting concrete girders, beams, joists, slabs, walls, or other members subject to bending stress, shall not be removed or released in less than 14 days after the concrete has been placed. Falsework and forms supporting members shall not be removed until the concrete has attained a compressive strength of at least 2,500 psi based on test results of field-cured cylinders. Such members shall not be loaded until the concrete has attained its 287 day compressive strength.
- D. Falsework forms shall be arranged so that they may be readily removed without hammering or prying against the concrete.
  - E. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

### 3.6 REUSE OF FORMS

Reuse of forms will be approved provided they are in good condition' and have been cleaned, repaired, and resealed as required to achieve concrete of the specified quality and texture. Do not reuse form facings more than four times.

END OF SECTION



SECTION 03200  
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and supervision required to furnish and install all steel reinforcing bars, wire fabric and accessories for cast-in-place concrete and masonry as shown on the Drawings and specified herein.

1.2 RELATED WORK

- A. Section 03300 - Cast-in-Place Concrete

1.3 REFERENCES

- A. ACI 301      Specifications for Structural Concrete for Buildings.
- B. ACT 315      American Concrete Institute - Detailing Manual
- C. ACI 318      Building Code Requirements for Reinforced Concrete, Latest  
Revision
- D. AWS D1.4      Structural Welding Code
- E. CRSI          Manual of Standard Practice
- F. ASTM          American Society for Testing and Materials Standards

1.4 SUBMITTALS

- A. Shop Drawings:  
  
Submit reinforcing steel shop drawings, prepared in accordance with ACI 315, showing sizes, cutting, bending, and placement details, splicing and laps, and any welding required or proposed.
- B. Coordination Drawings:  
  
Check all drawings for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast-in-concrete, and shall coordinate and develop drawings as required so that reinforcing steel will not interfere with the placement of such embedded items.
- C. Mill Test Reports:  
  
Submit certified mill test reports (tensile and bending), for each heat or melt of

steel, showing physical and chemical analyses, before delivery of any material to the job site. Where reinforcing is required or welding is requested, mill test reports shall verify the weld-ability of the steel.

#### 1.5 QUALITY CONTROL

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Practice.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Ship reinforcement and store with bars of the same size and shape, fastened in bundles with durable tags, marked legibly with waterproof markings. Use the same markings as shown on Drawings.
- B. Store off the ground and protect from moisture and kept free from dirt, oil, or other injurious contaminants. Steel, which cannot be properly identified, will be rejected, and immediately removed from the work.

#### 1.7 SPECIAL REQUIREMENTS

- A. Furnish the Engineer one copy each of ACI 315 and CRSI Manual of Standard Practice.

### PART 2 — PRODUCTS

#### 2.1 REINFORCING MATERIALS

- A. Steel Bars: Reinforcing steel bars shall be ASTM A 615/A 615 M, Grade 60, deformed billet bars, except where otherwise indicated in the Drawings.
- B. Steel Wire: Cold drawn, plain, ASTM A 82, unless otherwise indicated.
- C. Welded Steel Wire Fabric: Plain, ASTM A 185, unless otherwise indicated, and furnished flat, not rolled.

#### 2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed wire, plastic coated.
- B. Supports and Spacers: Provide spacers, chairs, bolsters, precast mortar blocks and other devices to support and secure reinforcement in place. Use plastic tip chairs for exposed finished concrete surfaces.
- C. Other: DPW' Standard Specifications, Section 411.

## 2.3 FABRICATION

- A. Fabricate reinforcing steel to conform to the required shapes and dimensions, in accordance with CRSI standards. Field bending will not be permitted except for No. 5 bar and smaller.
- B. Cold bent bars.
- C. Bend bars around a revolving collar having a diameter not less than that recommended by the ACI 318. Hooks shall conform to the same code.
- D. Sawcut bars to be butt spliced. Do not torch cut.
- E. Bars shall not be damaged and bars with kinks or improper bends shall not be used.

## PART 3 - EXECUTION

### 3.1 PLACEMENT

- A. Clean reinforcement before placing concrete of mortar, oil, grease, dirt, loose mill scale, loose rust, and any other coating of a character that might destroy or reduce the bond.
- B. Firmly secure reinforcing bars at intersections with tie wire. Use devices or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to prevent displacement of reinforcement during a concrete pour.
- C. Minimum clearance for reinforcement adjacent to concrete surfaces and minimum clearance of bar spacing shall be no less than values specified in the "Building Code Requirements for Reinforced Concrete" (ACI 318).
- D. Placing bars on layers of fresh concrete as the work progresses, or adjusting bars during the placing of concrete, will not be permitted.

### 3.2 SPLICING

- A. Lap Splices:
  - 1. Splice reinforcing bars as indicated, securely wiring the lapped bars together. Splices at locations other than those indicated on the Drawings are subject to the approval of the Engineer. Splices shall be no less than 40 times the bar diameter or 12" in length, whichever is greater.

2. Splices in welded wire fabric shall be lapped not less than two times the mean size, or 12" in length, whichever is greater. The spliced fabrics shall be tied together with wire ties a minimum of 2 ft. on center.

B. Welded Splices:

- a. No reinforcing bars shall be welded either during fabrication or erection unless specifically called for on the Drawings, specified, or with the prior written consent of the Engineer. All bars that have been welded without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall conform to the AWS Structural Welding Code-Reinforcing Steel, AWS D1.4. If the Contractor chooses to use ASTM- A706/A 706 M reinforcing steel to facilitate welding, it shall be at no extra cost to the Owner. Continuous inspection by a testing laboratory at Contractor's expense is required during all reinforcing steel welding.

### 3.3 REINFORCEMENT AROUND OPENINGS

- A. Whenever conduit, piping, sleeves, bolts, hangers, boxes or other embedded items interfere with the proper placement of reinforcing steel as detailed, the Contractor shall develop drawings to coordinate the work and submit them to the Engineer. Bars shall not be bent around openings or sleeves. Extra bars shall be used instead.

### 3.4 INSPECTION

- A. Before any concrete is placed, the Engineer shall inspect the reinforcing steel placement. Any errors or discrepancies shall be corrected prior to concrete placement. Notify the Engineer not less than two working days before inspection of reinforcing steel placement is needed.

END OF SECTION

SECTION 03300  
CAST-IN-PLACE-CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

The work shall include constructing slab foundations for mechanical and electrical equipment, all pole foundations; landscape architectural site walls, curbs, seat and bench supports, fence posts, paving, bands, mowbands, headers, subslabs and footings; and other cast-in-place work. This work shall include providing miscellaneous related items, including, but not limited to, joint materials and systems, earthwork, finishing, curing, protection, edge protectors, embedments, and other work as shown on the Drawings and specified herein.

1.2 INCLUDED WORK

- A. Section 02200 - Earthwork
- B. Section 03100 - Concrete Formwork
- C. Section 03200 - Concrete Reinforcement
- D. Section 03330 – Architectural Cast In Place Concrete

1.3 RELATED WORK

- A. Section 02510 - Asphalt Concrete Paving
- B. Section 02520 - Portland Cement Concrete Paving
- C. Section 03450 – Architectural Precast Concrete

1.4 REFERENCES

- A. AASHTO M 171 Standard Specifications for Sheet Materials for Curing Concrete.
- B. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 301 Specifications for Structural Concrete for Buildings
- D. ACI 302.1R Guide for Concrete Floor and Slab Construction.
- E. ACT 303R-74 Guide to Cast-in-Place Architectural Concrete Practice

- F. ACI 305R Hot Weather Concreting.
- G. ACI 306R Cold Weather Concreting.
- H. ACI 309R Guide for Consolidation of Concrete.
- I. ACI 347R Guide to Formwork for Concrete.
- J. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- K. ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- L. ASTM C 78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
- M. ASTM C 94 Standard Specification for Ready-Mixed Concrete.
- N. ASTM C 138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
- O. ASTM C 143 Standard Test Method for Slump for Hydraulic Cement Concrete.
- P. ASTM C 150 Standard Specification for Portland Cement.
- Q. ASTM C 157 Standard Test Method for Length Change of Hardened Hydraulic -Cement Mortar and Concrete.
- R. ASTM C 171 Standard Specification for Sheet Materials for Curing Concrete.
- S. ASTM C 309 Standard Specification for Liquid Membrane - Forming Compounds for Curing Concrete.
- T. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete.
- U. ASTM C 881 Standard Specification for Epoxy - Resin - Base Bonding Systems for Concrete.
- V. ASTM C 920 Standard Specification for Elastomeric Joint Sealants.
- W. ASTM C 979 Standard Specification for Pigments for Integrally Colored Concrete.
- X. ASTM C 1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- Y. ASTM C 1028 Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal

Dynamometer Pull Meter Method.

- Z. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- AA. ASTM D 98 Standard Specification for Calcium Chloride.
- BB. ASTM D 994 Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- CC. ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- DD. Standard Specifications, Parts 2, 4 and 8.

## 1.5 SUBMITTALS

- A. Cement: Submit for approval product data and manufacturer's instructions. Furnish copies of mill certificates, shipping receipts showing source and the cement manufacturer's quality control reports certifying compliance with requirements detailed herein.
- B. Aggregates: Submit test reports showing that aggregates meet Specifications.
- C. Admixtures: Submit product data and manufacturer's instructions for approval prior to the Engineer's review of mix design submittals. Furnish certification, which confirms that admixture conforms to ASTM C 494.
- D. Concrete: Submit proposed mix designs prepared by a recognized testing laboratory. Show the following information for each mix:
  - 1. Proportion of components in the mix.
  - 2. Brand of cement and type.
  - 3. Source, gradation and physical and other properties of aggregates.
  - 4. Water-cement ratio by weight.
    - a. Not required for lean concrete.
  - 5. Compressive strengths in accordance with ASTM C 39 at 48 hours, 72 hours, and 28 days as specified.

6. Shrinkage with and without admixtures in accordance with ASTM C 157.
7. The time required to assure a minimum compressive strength of 3500 psi.
  - a. Not required for lean concrete.
- E. Manufacturer's product data specifications with application and installation instructions for all proprietary products, including admixtures, bonding agents, joint materials and systems, embedded items, curing materials, sealants, grouts and any materials that are integral to concrete work.
- F. Test Reports: Aggregate and Fiber physical characteristics.
- G. Stair nosings: 4" sample.
- H. Shop Drawings: Submit placement drawings showing proposed locations and details of construction joints; reinforcing steel placement, locations of embedments and block outs; location and sizes of concrete bases for all equipment; and hand holes, manholes, drain inlets, and other elements. Submit working drawings, including proposed layout, dimensions and finished elevations, based on the data provided.
- I. Concrete site walls and bench Shop Drawings: Do not proceed with the construction of the cast-in-place concrete site walls or benches in the project, including fabrication of the formwork, until all samples, product data, first install and shop drawings have been approved by the Landscape Architect.
- J. Formwork Shop Drawings:
  1. Submit drawings showing the layout and details of formwork for the work, including the first install's.
  2. Drawings shall include plans, elevations and sections to show layout of all exposed-to-view concrete work and interfacing adjacent concrete work and will include all walls, columns, soffits, stairs, cast-in items, depressions, openings, recesses, reveals, ties, control joints, construction joints and water-stopped joints; all dimensioned with reference to the structural grid lines shown. Drawings shall be in a minimum 1/4"=1'-0" scale.
  3. Shop drawings shall include the following details:
    - a. Details of shop assembly of formwork and field assembly of



construction and control joints, reveals, recesses, embedments, ties, back-up, clean out panels.

- b. The means to be used to seal all joints, including back up bracing, dry ties and brackets.
- c. The means to be used to maintain alignment, including back-up bracing, etc.
- d. Cover of all concrete over reinforcing steel.

- 4. Location of clear placing passages through the steel reinforcing for placing trunks and gremmies.

K. Quality Control Records.

L. Hot and Cold Weather Procedures.

## 1.6 QUALITY CONTROL

### A. Concrete Mix Design

- 1. Concrete mix designs shall be designed and tested by Contractor's testing laboratory. Submit product information for all constituent materials of design mixes. No concrete work shall begin until the Engineer has approved that concrete mix design.
- 2. Mix designs shall be proportioned in accordance with ACI 301. Reinforced concrete shall be free of chloride ions.
- 3. Final approval is contingent on the appearance of the constructed concrete and test results.

### B. Aggregate Testing

- 1. Aggregate testing shall be done by the Contractor's testing laboratory to determine gradation, physical properties, sand equivalent, cleanliness and conformance to Specifications. Acceptability of aggregate shall be determined by the Engineer on the basis of test reports from the Contractor's testing laboratory and appearance of the constructed concrete.

### C. Tolerances:

- 1. Formwork: Tolerances for formwork shall be as specified in ACI 347R, except where other tolerances are indicated or lesser tolerances are

necessary to coordinate with other work.

2. Tolerances for finished concrete shall be as specified in ACI 117 for the appropriate surface, except where other tolerances are indicated, or lesser tolerances are necessary to coordinate with other work.

D. Defective work is any work, which does not comply with all requirements of the Contract Documents; including concrete showing cracks, rock pockets, voids, spalling or visual -defects.

1. The Engineer may require defective work to be demolished and rebuilt whenever, in his/her opinion, the work cannot satisfactorily be corrected, to comply with the Contract requirements.
2. The Engineer may request that the Contractor take core borings in accordance with ASTM C 42 and make tests of the concrete removed if the Engineer feels that the -- concrete might be defective.

The Contractor shall repair the damage as a result of testing to the satisfaction of the Engineer.

E. Mock-Ups for concrete paving, wall and bench in Materials Schedule:

1. Provide full-scale mock-up. Construct at least 2 weeks before start of other concrete work to allow concrete to cure before observation.
2. At location on Project selected by Owners Representative., demonstrate each forming and finishing condition required on Project using materials, workmanship, joint treatment, curing method, to be used throughout Project. Paving mock-ups shall be a minimum 4-foot square for each type of finish.
3. Accepted mock-up provides visual standard for work of Section.
4. Mock-up may remain as part of Work.

## 1.7 JOB SITE CONDITIONS

A. Hot-Weather Placement: Comply with the recommended practices of ACI 305R and the requirements specified herein. Procedures for hot weather concreting will be subject to the approval of the Engineer.

The Contractor is prohibited from placing any concrete when climatic conditions at the work site can be shown to produce an expected evaporation

rate of 0.2 lb/ll<sup>2</sup>/hr or greater. The relationship between temperature, humidity, and wind velocity, which will produce this evaporation rate, is shown in ACI 305R.

- B. Cold-Weather Placement: Comply with the recommended practices of ACI 306R and the requirement specified herein. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Procedures for cold weather concreting will be subject to the approval of the Engineer.
  - 1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and do not allow the temperature of the air in contact with the concrete to drop below 40°F.
  - 2. Do not place concrete on frozen sub-grade or on sub-grade containing frozen materials.
  - 3. Do not use calcium chloride or salt. Do not use other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- C. Examine work areas and conditions under which work of this Section is to be performed. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

## PART 2 -PRODUCTS

### 2.1 MATERIALS

- A. Cement: Cement for similar concrete elements shall be of same brands, types and sources throughout the contract and shall be ASTM C 150, Type II unless otherwise stated below.
  - 1. 1.1 parts (by weight) mineral admixture conforming to ASTM C 618 Class F may be substituted per part of Type II cement.
- B. Aggregate: Aggregates shall be crushed stone, gravel, and natural or manufactured sand conforming to the requirements of Standard Specifications Sections 800.03, 800.04, 800.05 and 800.06, except as modified by the contract documents. Aggregates shall be from sources with proven history of successful use and free of alkali, salts, organic matter, and other substances that may be deleterious to concrete or steel or affect bonding.
  - 1. Coarse Aggregate:
    - a. Aggregates shall not contain more than 2% soft particles, 1%

chert, 2% hard absorbent particles, or a total of 4% of these materials. Loss by washing shall not exceed 1.5%.

- b. Size: The maximum aggregate size shall be selected by the Contractor and shall not be more than 1/2 inch unless otherwise indicated on the Plans or specified, including referenced Standard Specifications or Plans.
  - c. Cleanness value shall not be less than 75 when tested in accordance with California Test Method No. 227.
- 2. Fine Aggregate: Sand equivalent shall not be less than 75 when tested in accordance with California Test Method No. 217.
  - 3. Patching: Aggregates for exposed visible concrete surfaces shall be selected and graded to match adjacent concrete in color and appearance.
  - 4. For exposed surfaces: Do not use fine or coarse aggregates that contain substances that result in spalling.
- C. Water: Water shall be cold, potable, clear, and free of injurious amounts of oil, acid, alkali, salts, organic matter, and other substances that may be deleterious to concrete or steel.
- D. Admixtures: Admixtures shall be compatible. The amount and type of admixtures used shall not increase the drying shrinkage of the concrete in excess of 10% of similar concrete without admixtures. Admixtures containing significant amounts of sulfides, nitrites or compounds, which may be deleterious to concrete, shall not be used. Admixtures containing chloride ions shall not be used.
- 1. Water-Reducing Admixture: Water-reducing admixture conforming to ASTM C 494, Types A, E, F or G shall be used. Amount shall be as needed for workability, finishing, minimizing bleed water, increasing early strength, reducing shrinkage and creep, and controlling temperature.
  - 2. Plasticizer: Conforming to ASTM C 1017 shall be used as necessary for workability.
  - 3. Fiber: 100% polypropylene, collated, fibrillated fibers specifically manufactured for use as concrete reinforcement in accordance with ASTM C 1116 and ASTM C 1018.

Required physical characteristics:

Specific Gravity: 0.91

Tensile Strength: 70 to 100 ksi  
Fiber Length: 3/4 inch — graded

- E. Concrete Bonding Agent: The bonding agent shall be high-strength, two-component thixotropic epoxy adhesive specifically formulated for bonding new concrete to old, and shall be in conformance with ASTM C 881, Type V; Burke Epoxy MV (Grade 2 of 3) or Sikadur 32.
- F. Curing Materials:
1. Curing compound: ASTM C 309, Type 1, Class B, free of substances which might be deleterious to the concrete.
  2. Sheeting: ASTM C 171 or AASHTO M 171, non-staining.
- G. Other materials: Other materials shall be in accordance with DPW Standard Specifications Section 800.14, except as modified by the requirements herein.
1. Joint Materials:
    - a. Expansion joints without joint sealant (Unsealed Joints):  
Pre-molded Expansion Joint Filler (Bituminous Type)  
ASTM D 994; minimum thickness 1/2 inch.
    - b. Expansion joint filler for sealed joints:  
  
Flexible foam expansion joint filler complying with ASTM D 1752 and having the following physical properties determined in accordance with method ASTM D 545  

|                           |                  |
|---------------------------|------------------|
| Compression, 50%          | 10 to 25 psi     |
| Extrusion                 | 1/4 inch maximum |
| Recovery                  | 95% minimum      |
| Water absorption, volume% | 0.5% maximum     |

Ceramar manufactured by W.R. Meadows
    - c. Control joint material: Sealtight "Speed-E-Joint preformed Contraction Joint" as manufactured by W.R. Meadows, Inc., or "Plastic Zip Strip Joint Former" as manufactured by the Burke Co., minimum depth shall be 1/4 the thickness of the concrete.
  2. Form Release Agent: Non-drying, non-staining, not deleterious to metal or concrete, and suitable for coating ferrous metal.
  3. Backer Rod: Extruded closed-cell polyethylene foam rod such as WEL backer rod as manufactured by Industrial Systems Dept., Plastic Products Group of Hercules, Inc., or Ethafoma SB as manufactured by DOW Chemical Co.

4. Joint Sealant: Non-sag one-part polyurethane conforming to ASTM C 920, and as manufactured by: Sikaflex Corp. or PRC230 or PRC210/220 by Products Research and Chemical Corp. DyMonic Tremco. Colors as selected by the Engineer.
5. Bond Breaker: Bond Breaker shall be required where bituminous expansion joint filler is used for sealed joints. The Bond Breaker shall be Snap-Cap joint cap, manufactured by W.R. Meadows or Burke. Bond Breaker, at the Contractor's option, may be used with non-bituminous expansion joint filler.
- H. Concrete test cylinders shall be cast at a rate of 4 test cylinders per 100 cubic yards or portions thereof for each individual concrete type placed each day.
- I. Stair nosings: Provide Spectra type WP24A 2 1/16" wide, 3/8" thick", safety treads/nosings as manufactured by Wooster Products Inc. for exterior stairs. Safety nosings going into new poured concrete or cement fill shall be installed before "Initial Set" of the concrete or cement occurs. Use protective tape per manufacturer recommendation. Stair nosings shall be black in color.

## 2.2 CONCRETE

- A. Concrete shall be composed of cement, aggregates, water, admixtures, and polypropylene fiber mixed in the proportions stated in the approved mix design.
  1. Minimum Strength: Concrete shall obtain fifty percent of its 28-day strength within the initial 72 hours after placement. The 28-day strength of concrete is 4000 psi, unless otherwise noted.
    - a. For lean concrete, including concrete used for fill, bedding, ductbanks, conduit encasement, and similar purposes, the 28-day strength is 1000 psi, unless otherwise noted.
    - b. For unreinforced concrete for equipment or other anchorages and for sidewalks, curbs, gutters, and art element foundation, the 28-day strength is 3000 psi.
  2. Water-Cement Ratio: Shall not be more than 0.45 by weight for reinforced concrete, 0.40 for air-entrained concrete, and 0.55 for other work, except lean concrete.
  3. Workability: Concrete shall be of such consistency and mix composition

that it can be finished to required appearance and it can be readily worked into the corners and angles of forms and around reinforcement, inserts, and wall castings without permitting materials to segregate or free water to collect on the surface. Due consideration shall be given to methods of placing, compacting, and finishing.

- a. Foundations, slabs on grade and grade beams shall have a slump minimum consistent with proper placing, in general shall be 3-1/2" to 4-1/2". Structural slabs shall have a slump minimum consistent with proper placing, in general shall be 2-1/2" to 3-1/2".
- b. Concrete for duct banks and conduit encasement shall have a minimum slump of 7 inches.

## 2.3 MORTAR AND GROUT

- A. For embedments, Five Star Grout (Five Star Product) or Rapid Set (CTS Concrete Manufacturing Company). Material shall be non-staining and achieve a 2,000 psi compressive strength and a bond strength of 1,500 psi in 24 hours. Shrinkage shall be less than 0.2 percent when tested in accordance with ASTM C 596. Consistency as applicable for the conditions under which it will be used.
- B. For water-tight connections or where epoxy is specified, non-shrink epoxy grout or mortar shall be a two-component, solvent free, moisture insensitive, low viscosity, high strength multi-purpose epoxy resin adhesive conforming to ASTM C 881 Types I and II, Grade 1, Class B and C. Consistency shall be as applicable for the conditions under which it will be used.
- C. Cement grout: shall conform to ASTM C 1107 and be mixed to produce a consistency as applicable for the conditions under which it will be used.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Perform work in accordance with Standard Specifications Section 411, except as modified by the indications on the Drawings and the instructions herein.
- B. Finished Concrete Surface shall be free of defects.
- C. Preparation

1. Complete demolition, earthwork, preparation of sub grade, concrete formwork and concrete reinforcement, before placing concrete.
2. Remove debris, mud and water from surfaces to receive concrete. All surfaces of forms and embedded materials to receive concrete shall be cleaned of all chips, wood, sawdust, dirt, mortar, grout and deleterious materials before the surrounding or adjacent concrete is placed.
3. No concrete shall be placed for any element until reinforcing for the same element is fastened in place nor until forms are complete. No concrete shall be placed before work that is to be embedded has been set. Reinforcing or other materials that have been set in place shall not be disturbed.
4. Notify the Engineer of the location, mix and estimated quantity a minimum three (3) working days prior to placing of any concrete.
5. Keyed Construction Joints: Coat joint surfaces with curing compound and allow to dry just prior to placing concrete against joint.
6. Contact surfaces of existing concrete (except keyed construction joints): Shall be cleaned and roughened by exposing clean solidly embedded aggregate by means of sandblasting or other approved methods. Just before placing new concrete, coat surfaces with epoxy concrete bonding agent.
7. All items to be embedded in the concrete shall be free from oil or foreign matter that would impede the bond of the concrete to these items unless otherwise noted.
8. Cover rail, reinforcement and embedments with water-soaked burlap so that their temperature will not exceed ambient air temperature immediately before embedding in concrete.
9. Fog-spray forms, steel reinforcement, and sub-grade just before placing concrete. Keep sub-grade moisture uniform without standing water, soft spots, or dry areas.
10. Immediately before placing concrete, verify that the formwork is complete and reinforcement and embedded items are secured accurately in place and that no water, ice, or other foreign matter is present in the forms or in contact with the reinforcing or subgrade.

### 3.2 MIXING AND TRANSPORTING

- A. General: Perform work in accordance with DPW Standard Specifications except as modified by the instructions herein.



1. Cool ingredients before mixing to maintain concrete temperature below 75° F during placement. Chilled mixing water or chopped ice may be used to control temperature, provided the water equivalent of the ice is calculated to total amount of mixing water. Liquid nitrogen may also be used to cool concrete.
2. Metakaolin may be batched into the drum as the first ingredient, batched in with the cement, or batched on top of fully mixed concrete mix. If it is batched as the first ingredient, the drum should not be rotated any more than is absolutely necessary until batching of the other material commences. Mixing shall be a minimum of one hundred and twenty (120) mixing revolutions.
3. Fiber: Mixing shall be a minimum of one hundred and twenty (120) mixing revolutions.

B. Conveying:

1. Transport concrete from mixer to place of final deposit as rapidly and directly as practicable and by methods which prevent segregation or loss of ingredients and displacement of reinforcement, and which avoid re-handling. Do not deposit partially hardened concrete.
2. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Equipment having components made of aluminum or magnesium alloys, which could have contact with plastic concrete, shall not be used.

### 3.3 PLACING CONCRETE

- A. General: Perform work in accordance with DPW Standard Specifications Section 800.14, except as modified by the instructions herein.
- B. Concrete shall not be used after it has begun to stiffen or the temperature of the concrete rises above 75° F.
- C. Depositing:
  1. Place no concrete when sun, wind, heat, rain or other condition occurs that could prevent proper finishing and curing. Depositing under water or in driving rain will not be permitted.
  2. Deposit concrete in layers not exceeding 12" in thickness, force concrete around and under reinforcing and embedded items without displacing them.

3. Integrate fresh concrete with that already placed. No re-tempering of concrete already placed shall be allowed. After concrete has taken an initial set, protect forms from jarring and do not place any strain on ends of projecting reinforcement.
4. Splash or accumulation of hardened or partially hardened concrete shall be removed during placement of concrete. Contact faces of forms for exposed concrete shall be protected from splash during placement of adjacent concrete.
5. If during placement there is a delay of more than 15 minutes, vibrate previous lift just prior to placing new concrete.
6. An interruption longer than 45 minutes shall be cause for discontinuing casting of that section of the work. In this event, cut back concrete and provide construction joints, clean forms and reinforcing as necessary to receive concrete at a later time.

### 3.4 CONSOLIDATION

- A. Concrete shall be thoroughly consolidated by mechanical vibration directly in the concrete. Thoroughly work concrete around reinforcing and embedded items and into corners and shapes of formwork. Eliminate air and gravel pockets that may cause honeycombing, pitting and planes of weakness.

One vibrator will be required for each location where simultaneous placing takes place, to ensure thorough vibrating of all sections. Provide sufficient spare vibrators on the jobsite so as to have them readily available in case any vibrator in use should suddenly cease to function properly.

Place no vibrator closer than 2 ½" from the face of the concrete.

Do not spread concrete with vibrators or attach the vibrator to the forms or reinforcing.

- B. Mechanical vibrators shall be of the flexible immersion type having a frequency of not less than 8,000 rpm. Use and type of vibrator shall conform to ACI 309R.
- C. Consolidate slabs 4" and less in thickness by means of vibrating screeds or; for small areas such as curbs use metal tampers.

### 3.5 JOINTS

- A. Joints shall be located as indicated on the Drawings and as specified. Joints shall be the full width-of the concrete element, evenly spaced apart and in line with adjacent joints unless otherwise indicted. Wherever concrete is placed over concrete that has already set, joints shall be constructed in the new

concrete in line with the joint in the concrete below.

1. Construction joints shall be formed and shaped with a keyway unless otherwise indicated on the Plans. The location of construction joints requires the Engineer's prior approval.
2. Control Joints:
  - a. Form joints in plastic concrete by grooving surface with cutting tools and finishing edges with jointer or saw cutting. Joints shall be made complete as shown; crossing joints shall physically intersect, and joints extending to vertical surfaces shall be fully made.
  - b. Tooled control joints – Tool joints to depth as shown on plans. When not indicated, provide spacing equal to slab width and not greater than 5'-0" on center.
  - c. Saw cutting for Control joints should be performed:

Before concrete starts to cool, as soon as the concrete surface is firm enough not to be torn or damaged by the blade, Saw cutting shall be performed within 12 hours of concrete placement. Curing materials shall be reapplied after saw cutting.

Before random drying-shrinkage cracks can form in the concrete slab.

Cutting should be undertaken sequentially to reduce the longest length of the slab, avoiding the creation of long, thin panels. Then cutting across the width of the slab/panel from the middle of one long side to the middle of the opposite long side
3. Expansion Joints and Edging:
  - a. Provide expansion joints at the location and intervals as shown on the approved shop drawings, and at all locations where paving abuts any vertical surface such as: buildings, walls, and other structures.
  - b. Place approved joint material prior to concrete placement, and secure in place to prevent movement.
  - c. Form joint and other edges in the plastic concrete using an edging tool to provide a smooth uniform impression.
  - d. Strike all edges before and after finishing.

### 3.6 CONCRETE FINISHING

- A. Produce finishes in accordance with Drawings and ACI 301, unless otherwise

indicated on the including Standard Plans, or as specified, including Standard Specifications.

Flatwork: All surfaces exposed to the weather shall be sloped for drainage. Do not apply water for finishing purposes or more than a fine coating of moisture to the concrete.

1. Sand-Blast Finish:

- a. Schedule: Perform sand-blasting no sooner than 10 days after pouring each section of concrete.
- b. Continuity: Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.
- c. Depth of Cut: Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to be approx. 1/16 in. depth. (approx. 1/8 in. to 3/16 in. depth.) (approx. 3/16 in. to 1/4 depth.)
- d. Backup Boards: Blast corners and edge of patterns carefully, using backup boards in order to maintain a uniform corner or edge line.
- e. Uniformity: Use same nozzle, nozzle pressure and blasting technique as used for sample panel.
- f. Control: Maintain control of abrasive grit and concrete dust in each area of blasting.
- g. Clean Up: Remove all expended abrasive grit, concrete dust and debris at the end of each day of blasting operations

2. Normal Broom Finish: All exposed surfaces, which will normally experience foot traffic, such as sidewalks, platforms, etc. Direction shall be perpendicular to the direction of traffic.

- a. Surfaces with slopes greater than 2% shall be slip resistant with a coefficient of friction of 0.8 minimum, per ASTM C 1028, wet or dry.
- b. Horizontal surfaces (2% or less) shall be slip resistant with a coefficient of friction of 0.6 minimums, per ASTM C 1028, wet or dry.

3. Float Finish: Unformed surfaces to be covered by fill material.

4. Troweled Finish: On all other surfaces.

5. Patching: Match adjacent existing concrete.

B. Use steel/magnesium tools only. Wood trowels and floats shall not be used.

- C. Unless otherwise indicated, all exposed concrete surfaces shall have Class 1 Surface Finish in accordance with DPW Standard Specifications Sections 411.10 and 411.11.

### 3.7 CURING

All new concrete shall be cured in accordance with Standard Specifications Section 800.16, except as modified by the indications on the Drawings and the instructions herein. Curing shall commence as soon as free water leaves the surface of the concrete.

- A. The preservation of moisture for concrete surfaces placed against wooden forms shall be accomplished by keeping the forms continuously wet for seven (7) days. If forms are removed prior to seven (7) days, other curing methods shall be used for the balance of the seven (7) day period.
- B. Curing Compound Method: Apply immediately upon initial concrete set. Reapply if disturbed. When applying compound, the surfaces may be damp but shall be free from standing water. Using pressurized spray equipment, apply compound in two directions perpendicular to each other in sufficient thickness to prevent evaporation from the concrete and plastic shrinkage. Reapply to repair damage or wear until curing is complete. Curing compounds that may be detrimental to the bonding of any material to be applied to the concrete, such as sealants, paint or surface hardener shall not be used.
- C. Flatwork: Between screeding and 2 hours after initial concrete set, continuously fog above the concrete surface with a device that atomizes the flow of water so that a mist and not a spray is formed. Fog to maintain a wet sheen on the surface from time of placement. After the 2 hours continue curing as specified above.

### 3.8 PROTECTION

Protect concrete from weather, sun, rain, and mechanical injury, until thoroughly set and of sufficient strength to prevent damage from possible loads.

- A. Concrete shall be protected from the wind and the direct rays of the sun for initial 24 hours after placement.
- B. Do not allow the temperature of the air in conflict with the concrete to fall below 40° F for the initial 24 hours after placement.
- C. Concrete shall be protected from vehicle and other loads until a compressive strength of 3500 psi or its 28-day strength has been attained, whichever is less. The Contractor's testing laboratory shall perform testing to determine the time required to assure the required compressive strength.

1. Even when concrete strength is sufficient to prevent damage, protect from loading for a minimum of 16 hours after initial concrete set.

### 3.9 FIELD QUALITY CONTROL

#### A. Records:

1. In addition to the information specified in ASTM C 94 to be provided on the delivery ticket with each batch of concrete, provide the following information on the same ticket to the Engineer prior to concrete placement.
  - a. Reading of the revolution counter at the first addition of aggregates to the mixer.
  - b. Time of day at which cement and aggregates are first intermingled, and at which water and cement are first intermingled:
  - c. Mix identification.
  - d. Concrete temperature at the time of placement.

#### B. Inspection:

1. No placement shall be made without the inspection and acceptance of the Engineer.
2. When forms are removed, voids, stone pockets and other defects shall not be remedied until the Engineer has inspected them and given his directions.
3. The Owner's use of its testing laboratory does not relieve the Contractor from tests that may be required for the proper execution of his/her work or tests needed to determine if concrete strength is serviceable. The Contractor shall perform such tests.
4. Drainage: The Contractor shall satisfactorily demonstrate the proper drainage of the constructed work. The Contractor will flush with water approximately 50 feet of the upstream end of the work for two minute with a minimum flow rate of 0.02 cubic feet per second or approximately 20 gallons equivalence. After five minutes, the Engineer and Contractor shall make a visual inspection for ponding.

### 3.10 REPAIRS

- #### A.
- Immediately after removal of forms, inspect surfaces for defects. Repair defects within 48 hours after removal of forms and cure simultaneously with

concrete. If rock pockets, in the opinion of the Engineer, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the concrete affected at Contractor's expense.

- B. Where patchwork is allowed, it shall match adjacent surfaces in color and texture. Determine exact mix by trial mixtures before patching; obtain approval of samples of mix proposed prior to application. Prime surface with epoxy resin adhesive.
- C. Before final acceptance of the work, neatly repair damaged surfaces, edges, corners and finish, whether such damage shall have resulted from the action of the elements or from any cause whatsoever. All repairs shall be brought to a smooth, dense, watertight condition to the satisfaction of the Engineer.

### 3.11 CLEANING

- A. Clean exposed surfaces of new concrete and adjoining concrete, brick, asphalt, metal and other surfaces. Grind, sandblast, high pressure wash and stream clean as needed to remove oil, paint, asphalt, stains, extraneous concrete, curing compound, graffiti and other surface defacements.
- B. Clean all joints. Fill sealed joints with approved joint sealant flush with the concrete surface in such a manner as to avoid spilling or overflow from joint.
- C. Patching:
  - 1. Corrective Patching: Correct all defects in concrete work. Chip all voids to a depth of at least 1 in. with the edges perpendicular to the surface and parallel to form markings. Fill all voids, surface irregularities, or honeycombing by patching or rubbing. Insure that all concrete surfaces so repaired duplicate the appearance of the unpatched work.
  - 2. Defective Work: Remove in its entirety and replace all defective concrete work, which after corrective patching, rubbing, etc., fails to duplicate the appearance of unpatched work and/or conform to the standards set forth in these Specifications.

## PART 4 – FINISH SURFACE SCHEDULE

4.01 See Drawings for concrete paving, walls and benches finish surface schedule.

END OF-SECTION

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## SECTION 03330

### ARCHITECTURAL CAST IN PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

##### 1.2 SUMMARY

- A. This Section includes:

1. This section includes requirements for Cast-in-Place Architectural Concrete work for Overlook walls.
2. Requirements for Cast-in-Place Architectural Site Concrete, including formwork, affecting the finished appearance of the Work.

- B. Related Sections include:

1. Section 02200: Earthwork
2. Section 03100: Concrete Formwork
3. Section 03200: Concrete Reinforcement
4. Section 03300: Cast-in-Place Concrete
5. Section 05501: Site Metal Fabrications for custom Guardrail mounts at Overlook
6. Section 09965: Graffiti Resistant Coatings

##### 1.3 DEFINITIONS

- A. Architectural Site Concrete: Formed concrete that is exposed to view on surfaces of completed structure and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance. Surfaces of architectural concrete elements that are not exposed to view in the completed work, need not conform to requirements of this Section.

##### 1.4 REFERENCES

- A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.
- B. San Francisco Building Code, 2010 Edition, in conjunction with California Building Code, 2010.
- C. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in the 2013 "Annual Book of ASTM Standards".

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- D. American Concrete Institute's ACI 303.1 - Specification for Cast-in-Place Architectural Concrete, 2012.

## 1.5 SUBMITTALS

- A. General: Do not proceed with the construction of the cast-in-place architectural concrete in the project, including fabrication of the formwork, until all samples, product data, first install and shop drawings have been approved by the Landscape Architect.
- B. Product Data: For each type of product indicated, including but not limited to form facing material, form release agent, form ties, reinforcing bar supports, waterproofing admixtures, curing compound and cleaning solutions.
- C. Samples: For each concrete mixture prepare up to five (5) alternate samples in varying color and finish based on control sample provided by Landscape Architect for preliminary review and approval prior to mock up. Landscape Architect shall direct color & finish options prior to sample production. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts and type of color, aggregate, and finish/form for each sample.
  2. Samples to be 12"x12", minimum two samples per mix.
  3. Samples to demonstrate final color and finish.
  4. Approved final sample to serve as basis for site mock up.
- D. Formwork Shop Drawings
1. Submit drawings showing the layout and details of formwork for the work, including the first install's.
  2. Drawings shall include plans, elevations and sections to show layout of all exposed-to-view concrete work and interfacing adjacent concrete work and will include all walls, soffits, stairs, cast-in items, depressions, openings, recesses, reveals, ties, control joints, construction joints and water-stopped joints; all dimensioned with reference to the dimensions shown on the Drawings. Drawings shall be in a minimum  $\frac{1}{4}"=1'-0"$  scale.
  3. Shop drawings shall include the following details:
    - a. Details of shop assembly of formwork and field assembly of construction and control joints, reveals, recesses, embedments, ties, back-up, clean out panels.
    - b. The means to be used to seal all joints, including back up bracing, dry ties and brackets.
    - c. The means to be used to maintain alignment, including back-up bracing, etc.
    - d. Cover of all concrete over reinforcing steel.
    - e. Location of clear placing passages through the steel reinforcing for placing trunks and gremmies, sleeves and conduit.
- E. Expansion joint filler/sealer: submit sample for review.
- F. All vertical and horizontal dimensions of wall including reveals, formwork joints, lighting & conduit, and any other accessories.
- G. Certificates: For admixtures, concrete mix design, and concrete trial mixes, as specified under other applicable concrete Sections.

## 1.6 QUALITY ASSURANCE

- A. Comply with applicable provisions of following codes and specifications, except where more stringent requirements are shown or specified.
  - 1. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."
- B. Source Limitations: Obtain concrete mixture from one manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.
- C. The cast-in-place concrete Subcontractor, carpenter foreman, labor foreman and the reinforcing erector foremen shall have successful experience in performing architectural cast-in-place concrete work, specifically smooth formboard finish, and shall be approved for work on project. Submit projects, including name, description of responsibilities, scope of work, and references.
- D. Mock-up for Formed Concrete Work:
  - 1. After all samples, product data, and the shop drawings are approved construct a full scale mock-up as directed by landscape architect.
  - 2. Obtain approval of location and orientation of mock-up and approval of mock-up formwork shop drawings and products from landscape architect and mix design from engineer before mock-up formwork construction.
  - 3. Vary approved trial concrete mix design parameters including water-cement and fly ash ratio, fly ash content, and self-consolidating admixtures to achieve acceptable architectural finishes with proper workability, finishability, curing and setting time. Reconstruct mock-ups as required to obtain acceptance.
  - 4. Provide Contractor Quality Control and Owner Testing and Inspection Quality Assurance as for final work during mock-ups including certification of materials, mix design and casting and testing of test cylinders.
  - 5. Coordinate construction of mock-up with other site work as required.
  - 6. Mockup shall consist of the following :
    - a. Sample wall, L-shaped section, corresponding with Pour 2, a minimum of 6' long and 4' tall, or as directed by owner.
    - b. Use approved form face material, reinforcement and accessories and assemble formwork as intended for the building construction.
    - c. Mock up shall demonstrate all conditions including corners, top, sides, form seam lines, joints & joint sealer, reveals, form tie holes, lighting affects.
    - d. Finished exposed hardened surfaces of the walls with specified colors and finishes.
  - 7. If Mockup is not approved by the Landscape Architect, remove and replace with new Mockups at no additional cost to the Owner.

## 1.7 PERFORMANCE REQUIREMENTS

- A. Responsibility for the design of Cast-in-Place Architectural Concrete in conformance with the requirements of the drawings and specifications and performed using the highest standards of quality for visual and durable concrete rests with the Contractor.
- B. Design of the mix and formwork shall be performed by Contractor.
- C. Performance Criteria: All cast-in-place architectural concrete formwork shall be performed so that no evidence of the following will be evident when the concrete is subject to imposed loads, temperature and weather conditions:
  - 1. Damage of any kind.
  - 2. Formwork fastening penetrations or formwork anchoring devices or projections other than approved form ties and specified embedded items.
  - 3. Cracking, other than at control joints, due to improper forming and placing.
  - 4. Out of alignment or incorrect profiles.
  - 5. Surface voids not completely covered by a circle 11/16 inches in dia. (10 cent coin) or more than 25 surface voids larger than 1/8 inch, in longest dimension, in any area 1 ft. square.
  - 6. Voids, sand pockets or discoloration due to fluid loss through the formwork.
  - 7. Rock pockets and honeycombs.
  - 8. Discoloration caused from staining and from improper placing of the concrete.
- E. If any of the above-mentioned deficiencies occur, the Landscape Architect may order the affected concrete replaced or repaired with acceptable concrete. Repair only when directed by the Landscape Architect. Corrected deficiencies must meet with the Landscape Architect's approval.

## 1.8 WARRANTY

- A. Provide standard warranty with a duration of one (1) year in accordance with General Conditions. Warranty shall be in writing and shall warrant work under this Section to be free from defects for the period stipulated.

## 1.9 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, lighting fixtures, drain lines, foam infill, drain grates and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of Custom Guardrail mounts using mount location template owner provided with construction of Overlook concrete beams. Mounts and location template will be constructed by Artist and provided by Owner. Notify Artist 6 weeks prior to delivery to site for fabrication. See Section 05501 Site Metal Fabrication.

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## PART 2 PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. General: Comply with Division 03 Section "Concrete Formwork" for general requirements applicable to formwork and other form-facing material requirements, modified per this section for specific types of form facing materials required for visual appearance.
- B. Smooth flat form surfaces shall be plastic coated, birch plywood, minimum 14 plys per inch, 3/4" thick panels in sizes to cover surface areas between joint lines shown on the drawings. Panels shall be "FinnForm" (red) as manufactured by Plywood & Door Corp.
- C. Form Ties and Spreaders:
  - 1. Form Ties: Shall be manufactured specifically for use as concrete ties and shall be designed to seal tightly to the form face material without fluid loss. Ties shall be of sufficient strength to resist fluid concrete placing pressures at the longest span of support used in project. Ties shall be one of the following as selected by the Landscape Architect in the first install structure:
    - 2. Cone/Tube/Rod or Cone/Coil/Rod tie system with screw tie clamps. Cone size shall be maximum 1-3/4" diameter.
    - 3. Tapered He-bolt/Stud tie. Size of stud at contact face shall be 5/8" in diameter.
    - 4. Ties shall be as supplied by Engineered Devices Corp., Ridgefield Park, NJ. Ties: RJD Industries, Inc.: Supertie, Fiberglass Formtie System from RJD Industries - 800-344-4753.
    - 5. Alternate DwiDag Tie Holes: Atlas Construction Supplies Bob Wigman 858-277-2100 (If specified in architectural requirements.)
    - 6. Spreaders: Same as ties, cut to wall thickness.
    - 7. Spreader Clips: Proprietary clip to position spreaders adjacent to ties.
    - 8. Approved equivalent.

### 2.2 STEEL REINFORCEMENT AND ACCESSORIES

- A. General: Comply with Division 03 Section "Concrete Reinforcement" for steel reinforcement and other requirements for reinforcement accessories.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
- C. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected or CRSI Class 2, stainless-steel bar supports.

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## 2.3. CONCRETE MATERIALS

### A. General

1. Materials used shall be the same as those submitted and from the same source.
2. When it is proposed to change materials from those submitted, conform to paragraph 4.2.1.5 of ACI 301.

### B. Cement

1. Portland Cement Type II, ASTM C150.
2. The temperature of cement delivered to the plant shall not exceed 150 degrees F.
3. One brand from the same source shall be used for all exposed concrete.
4. There shall be no detrimental reaction between the cement and the aggregates used.

### C. Aggregate

1. General: Maximum size not to exceed 75% of clear spacing between reinforcement.
2. Normal Weight Aggregate: ASTM C33
  - a. Coarse Aggregate: Grade within limits shown or specified.
  - b. Fine Aggregate: Natural sand; grade within limits of 3/8" to no.100 sieve.

### D. Water: Clean, potable and free of deleterious matter. In addition, conform to ASTM C94 including the optional chemical tests.

### E. Admixtures:

1. Do not use admixtures.
2. Color Admixture: None.
  - a. Color: natural

### F. Finish: smooth, formboard finish.

## 2.4 CONCRETE MIXTURES

- A. Comply with the requirements of Section 03300 for Cast-in-Place Concrete, and as specified herein. Architectural concrete shall be self-consolidating except where designated on the drawings or where regular concrete is submitted and approved for use

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- B. Proportion concrete mixtures as specified in section 03300, "Cast-in-Place Concrete" and Drawings to achieve compressive strength indicated on the Drawings.
- C. Limit water to cement ratio to 0.45 and total water content to 275 pounds per yard, including liquid admixtures and water added on site.
- D. Provide 600 pounds per cubic yard minimum cement content. Avoid the use of increased cement to minimize thermal effects.
- E. Mix shall contain specified high range water reducing admixture (superplasticizer) to provide 8 inch slump at point of placement.
- F. Fly Ash Replacement allowed up to 25% by weight maximum.

## 2.5 CONCRETE MIXING

- A. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
- B. Before test sampling and placing concrete, water may be added at the site, subject to limitations of total mix design water, design slump, mix temperature and elapsed time from batching.
  - 1. Dose with high-range water reducing admixture, when slump loss is result of HRWR reaction.

## 2.6 MISCELLANEOUS MATERIALS

- A. Joint Sealing Materials: Per approved sample. Color to match architectural concrete color.
- B. Patching mortar for form ties and bug holes N/A (no patching of bug holes or form ties at exposed surfaces).
- C. Patching Additive N/A.
- D. Sealer: anti-graffiti sealer resulting in a matte finish as approved per Section 09965. Apply per manufacturer's recommendations.

## PART 3 EXECUTION

### 3.1 PRE-CONSTRUCTION MEETING

- A. At least one week prior to commencement of concrete work, meet at the project site to review methods and sequence of concrete construction, standard of workmanship, material selection, testing and quality control requirements, detailed requirements of the design mixes, placement procedures, off-site batching requirements, coordination of the work with other trades and other pertinent topics related to the work. Meeting shall include the following:
  - 1. Owner's Representative

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2. Landscape Architect / Engineer
3. Construction Manager / General Contractor
4. Concrete Sub-contractor
5. Formwork Supplier (Attendance by poly-overlay forming panel and framing manufacturers is encouraged, but not required.)
6. Any other subcontractor and/or material supplier or manufacturer required.

### 3.2 FORMWORK

- A. General: Comply with Division 03 Section, "Concrete Formwork", for fabricating formwork except where more stringent requirements are specified in this Section. Requirements for formwork herein apply only at exposed to view surfaces; other surfaces shall conform to requirements for structural concrete.
- B. Design formwork to permit easy removal. Prying against the concrete will not be permitted. Care shall be taken so as not to mar the concrete surface in cutting or removal of the forms.
- C. Design formwork for a full liquid head of pressure. The forms shall be completely rigid and strong enough to withstand without deflection, movement or leakage due to the placing pressures that result from rapid filling and vibration.
- D. Forms shall be fabricated so the concrete can be adequately placed, vibrated and finished to achieve the specified finishes.
- E. Panel Size: Panels shall be 3/4" 5'x6' DURA-POUR Matte Finish. Minimum overlay 3/4" 5'x12' DURA-POUR Matte Finish. Other panel sizes may be used if required to achieve jointing and tie layout shown on the drawings.
- F. Exposed Form Panel Edges: Seal panel edges with two coats of polyurethane edge seal to prevent moisture penetration, while also taking care not to get paint on faces of panels.
- G. Form Panel Backup: Back poly-overlay forming panels with second layer of 3/4-inch thick exterior grade plywood, stagger panel joints, and screw fasten face panel through back-up panel with sealant adjacent to the joint. Exposed fastener heads on polyethylene race not permitted. Provide rubber gaskets at all corners to provide a square watertight joint. Refer to industry guidelines as necessary, available from poly-overlay form panel manufacturer.
- H. Form Ties: Place in center of break-off fin. Caulk formwork to prevent leakage at penetration. To keep form dimension uniform, cut lengths of form tie rod to equal wall thickness and attach them to rod being used as a tie by using RJD's spreader clip. Assure that the end of the spreader also falls into the rustication joint.
  1. Layout form ties, form joints, reveals and exposed embedments as shown on the drawings. In areas not shown form joints and tie holes shall be laid out symmetrically and as near the pattern shown as possible and shall be submitted for approval by the landscape architect



2. Corners: Form outside and inside exposed horizontal and vertical corners square unless otherwise shown.
- I. Foam inserts: Back Fasten laser cut foam inserts to inside face of form and/or use adhesive to attach foam insert.
- J. Form Erection:
1. Use only form units where face panels are in undamaged condition. Replace damaged panels as required to maintain surface in a condition to achieve the specified treatment.
  2. Use screw type fastening devices to maintain alignment, and to tightly close joints at corners, end forms, square columns and at bulkheads. Apply pressure at joint to resist concrete placing pressure as close to the joint as possible.
  3. Construction joints and control joints shall be at locations indicated on the drawings.
  4. At corner joints, assembled and disassembled in field, place a gasket in the form joint. Install gasket away from contact edge 1/16" to 1/8".
  5. All corners, shall be formed with a tight seal (see item above) and with back-up support secured with screw connectors at sufficient intervals to maintain the seal under placing pressures.
  6. Reveals on the exposed form surfaces shall be of the shape, width and depth shown on the drawings.
- K. Coating of Forms: Prior to use, all forms shall be coated with the specified form release coating in accordance with the manufacturer's written instructions.
1. Coat evenly and remove excess material from form surface with a damp absorbent cloth.
  2. Surface applied with specified release agent shall not be oily to the touch.
  3. Do not allow coating to come in contact with previously placed concrete or with reinforcing steel.

### 3.3 FORMWORK TOLERANCES

- A. Hydraulic pressures: Design forms to limit deflections of members supporting facing panels to L/400. Formwork shall be designed for full liquid head.
- B. Finish Lines: Fabricate and position formwork to maintain hardened concrete finish lines within the following allowable variations.
1. From designed edge elevation in 10 ft: 1/4 inch
  2. From designed vertical plane in 10 ft: 1/4 inch
  3. Cross-Sectional Dimensions:  
Plus or Minus 1/4 inch
  4. Form surface to surface at butt joint: 1/32 inch
  5. It is the intent of this specification that the formwork will be erected in such a manner that lines and surfaces are visually presentable without obvious defects. Where lines and planes require adjusting from one placement to another humor the forms to realign in a visually acceptable manner.

### 3.4 REINFORCEMENT

- A. General: Comply with Division 03 Section, "Concrete Reinforcement", for fabricating and installing steel reinforcement, except where more stringent requirements are specified in this Section.
- B. Cover: Minimum concrete cover for reinforcing and tie wires shall be 2 inches, unless specifically detailed otherwise.
- C. Tie Wires: Set wire ties with ends directed into concrete, not toward exposed concrete surfaces. Keep tails as short as practical, so that concrete placement will not force ends to exposed surface.
- D. Provide bar supports at exposed face only as absolutely necessary to maintain cover. Use a combination of internal bracing and chairs and ties at concealed face to hold reinforcement securely in position.

### 3.6 PLACING CONCRETE

- A. Before placing concrete in the forms, verify that all forms have met all requirements specified; that reinforcing steel, embedded materials are in place and securely anchored; that forms are absolutely clean; and that entire preparation has been approved by the Concrete Quality Control Technician and has been reviewed by the Landscape architect.
- B. Cleaning and Protecting Forms: Immediately prior to placing concrete, clean all form interiors free of foreign material and debris.
  - 1. Force debris out of forms prior to closing the last section with a jet stream of compressed air and/or water. Where form openings are not available, collect debris with vacuum cleaners and heavy-duty magnets. Remove all wire clippings, sawdust and other debris from wall, beam and soffit bottoms.
  - 2. Protect cleaned forms if placing does not commence immediately, covering openings with tarpaulins.
  - 3. Do not allow direct sunlight to heat forms.
- C. Depositing Concrete:
  - 1. Concrete for walls, columns and spandrels more than 3 ft deep shall be placed with trunks, or pump hoses inserted onto the form cavity.
  - 2. Deposit concrete as nearly as practical at its final position, but not farther than 5 ft. horizontally from the final position.
  - 3. Do not drop concrete more than 12 inches.
  - 4. Place concrete by inserting pump hose, or trunks into form to face of fresh concrete. Place an adequate number of trunks in wall and deep spandrel forms to enable a continuous placement without causing delays in moving trunks.
  - 5. Deposit layers in walls shall not exceed 30 inches in height. Top deposit lift of placement shall not exceed 18 inches in height.
  - 6. Deposits of concrete in walls shall have a subsequent deposit place on top and/or adjacent to the fresh face and consolidated within 15 minutes. Plan construction joints and placements so that the placing sequence will follow this requirement.
- D. Consolidating Concrete:
  - 1. All concrete shall be consolidated by internal vibration using two vibrators at each placement. One vibrator shall follow deposit location and consolidate concrete after deposit is leveled. Optimum diameter of vibrator head shall be 1" to 1½". Vibrators shall be placed

into the concrete vertically at a consistent spacing that will thoroughly blend the deposits, remove entrapped air, and consolidate the concrete. Vibrator head shall be inserted rapidly and withdrawn slowly and evenly to remove maximum amount of entrapped air (optimum withdrawal speed approx. 2" to 4" per second). Do not jiggle vibrator up and down during consolidation, use continuous and even insertion and withdrawal of vibrator.

2. After top out leveling in walls and spandrels, the concrete shall be allowed to set 10 to 15 minutes and then shall be given a final vibration of the top 20 inches. Immediately thereafter the top surface shall be finished as required.
3. Caution must be exercised in using vibrators to prevent injury to the form surface material or displacement of embedded items.
4. Keep one spare working vibrator on site at all times.

### 3.7 CURING AND FORM REMOVAL

- A. Use consistent stripping time and curing method for exposed surfaces. Maintain surface appearance that matches approved field sample panels and mockups.
- B. For surfaces exposed to weather, leave formwork securely in place for 7 days and cover exposed top surface tightly with impervious sheeting.
- C. In hot weather, cover forms during curing period to protect from direct sunlight.
- D. Thoroughly wet surface immediately after loosening forms and again after form removal.

### 3.8 FINISHES for FORMED PLACEMENTS

- A. All exposed work shall be finished with the approved finishes determined from sample tests executed in Part 1 on the Mock Up or First Install. Finishes shall be as specified in Part 4 and where indicated on the drawings.
- B. Minor protruding defects such as fins may require removal. No filling of bug holes. Patching or other filling and surface repairs shall be avoided.
- C. Architectural Concrete at Overlook: Provide smooth, matte finish upon form removal with no patching, stoning or other form of repair, except washing, permitted unless otherwise noted, for walls, low walls, bench seat surfaces, and other surfaces visible to view when the work is complete, except on the interior of surfaces of the non-architectural concrete areas.
- D. Tie Hole Treatment:
  1. Exposed Tie Rod Ends: Cut off so that the remaining fiberglass rod fibers do not protrude beyond the face of concrete.
  2. Do not fill tie rod end holes.
- E. Sealer: Prior to treating, all surfaces shall receive the following preparation and cleanup.
  1. All surfaces to receive treatment shall be a minimum of 21 days old. All surfaces can be treated at end of project.
  2. Remove all stains using an appropriate non-abrasive stain remover for each type.
  3. During operations, protect all adjacent work. At completion of day's work, leave area clean. At completion of work, remove all equipment, waste and excess material and leave area clean.

### 3.9 PROTECTION

- A. Protect all Architectural Cast-in-Place Concrete surfaces from damage of any kind. Pay special attention to surfaces near work of other trades. All Architectural Concrete surfaces shall be free of damage at the time of acceptance. Allowing damage and patching or cleaning at end of project is not acceptable. Protection shall assure protection from paint, oils, rust, stains, impact, or any other kind.

### PART 4 – SCHEDULE

- 4.1 See Drawings for finish surface schedule for Overlook walls and ceilings.

END OF SECTION

## SECTION 03450

### ARCHITECTURAL PRECAST CONCRETE

#### **PART 1 - GENERAL**

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Architectural precast concrete units:
    - a. Custom Precast Concrete Furniture – “Pintos”
    - b. Custom Precast Concrete Furniture – “Sofas”
    - c. Custom Precast Concrete Furniture – “Picnic Booth Tabletops and Bench tops”
  - 2. Design, construct, transport and erect precast concrete units listed herein, including all anchorage as required to secure the precast unit to the primary structure in accordance with all applicable codes and standards. Work includes designing, providing and setting all anchors to be cast in place in the primary structure.
  - 3. Picnic Booth Tables and Benches: includes ultra high performance fiber reinforced precast concrete table top and steel base.
- B. Related Sections include the following:
  - 1. Section 03300 – Cast In Place Concrete for footings and installing connection anchors in concrete.
  - 2. Section 05501 – Site Metal Fabrications for hardware and mounting fabrications.
  - 3. Section 09965 - Graffiti Resistant Coatings

##### 1.3 DEFINITION

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

#### 1.4 SUBMITTALS

- A. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- B. Shop Drawings: Detail fabrication and installation of each type of precast architectural concrete component. Indicate plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement. Provide all drawings at a scale no smaller than  $\frac{1}{4}" = 1' - 0"$ .
  - 1. Indicate separate face and backup mix locations and thicknesses.
  - 2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.
  - 3. Indicate locations, dimensions, treatment of joints, electrical conduit holes, anchor bolt holes, and planter drainpipe holes.
  - 4. Submit stamped structural calculations including checks for stripping, lifting, transportation, erection and service conditions.
  - 5. Submit engineering calculations for review and approval, signed and sealed by the engineer responsible for the design.
- C. Samples: For each type of finish indicated on exposed surfaces of precast architectural concrete, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 18 by 12 by 2 inches.
  - 1. Finish Samples for Initial Selection: Provide samples of each finish below: Light Sand Blast, Medium Sand Blast, Heavy Sand Blast, Smooth, Acid Etch. Form Finish of actual sections of grout showing the manufacturer's full range of colors.
  - 2. Sand Blast - Light Exposure: the surface skin of cement and sand is removed just sufficiently to expose the surface of the coarse aggregate.
  - 3. Sand Blast - Medium Exposure: a further removal of the matrix exposes approximately the same area of both coarse aggregate and matrix.
  - 4. Sand Blast - Deep Exposure: cement and fine aggregate are removed to a depth where the coarse aggregate becomes the dominant surface feature.
  - 5. Smooth - as cast: concrete is placed against hard, smooth form work to achieve a smooth "as cast" finish on the precast element.
  - 6. Acid Etch: This finish is achieved by casting concrete against a smooth hard surface. After removal from the form the element is allowed to harden to a uniform hardness. The product is then washed with an acid solution and scrubbed to remove the cement surface to a sand surface level. The result is a smooth sand textured surface.
- D. Range Samples: After sample panel approval and before production fabrication of architectural precast concrete units, produce a minimum of three samples,

approximately 16 square feet in size, representing anticipated range of color and texture on project's units. Following range sample acceptance by the Architect, maintain samples at the manufacturer's plant as color and texture acceptability reference.

- E. Qualification Data: For fabricator and installer.
- F. Material Test Reports: For aggregates.
- G. Material Certificates: For the following items, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Reinforcing materials
  - 3. Admixtures.
  - 4. Structural-steel shapes
- H. Source quality-control test reports.
- I. Field quality-control test reports.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Engage a firm experienced in producing architectural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work. This responsibility includes preparation of Shop Drawings.
  - 1. Fabricator must participate in the Precast/Prestressed Concrete Institute's (PCI) Plant Certification Program and be designated a PCI Certified Plant for Group A1 -Architectural Concrete.
  - 2. Fabricator shall be registered and approved by authorities having jurisdiction.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 , that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- D. Quality-Control Standard: Comply with requirements of PCI's MNL-117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products," including manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required.

- E. Installer Qualifications: Engage an experienced Installer who has completed architectural precast concrete work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- F. Mockups / Molds: Landscape Architect shall review and approve full size model of each unit before final acceptance. After sample panel approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Mold casts may be used for the purpose of this review if they reflect the final form of the units.
  - 1. Build mockup as indicated on Drawings of the following:
    - a. Custom Precast Concrete Furniture – “Pintos”
    - b. Custom Precast Concrete Furniture – “Sofas”
    - c. Custom Precast Concrete Furniture – “Picnic Booth Tabletops and bench tops”
  - 2. Prepare mock ups and review of all units simultaneously.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
- F. Lift and support units only at designated points shown on Shop Drawings.



## 1.7 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Fabricators: Subject to compliance with above requirements, plant-precast architectural concrete fabricators capable of providing precast architectural concrete which may be incorporated in the work include the following:
  - 1. Concreteworks contact: Mark Rogero 1137 57th Avenue, Oakland, CA 94621  
Phone: (510) 772-4217 Email: mark@concreteworks.com
  - 2. Quick Crete Products Corp. P.O. Box 639, 731 Parkridge Avenue, Norco, CA 92860  
Phone: (951) 737-6240, Fax: (951) 737-7032
  - 3. Approved equal.

### 2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
  - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

### 2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

- C. Galvanized Reinforcing Bars: [ASTM A 615/A 615M, Grade 60 (Grade 420)] [ASTM A 706/A 706M], deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized.
- D. Epoxy-Coated Reinforcing Bars: [ASTM A 615/A 615M, Grade 60 (Grade 420)] [ASTM A 706/A 706M], deformed bars, [ASTM A 775/A 775M]
- E. Steel Bar Mats: ASTM A 184/A 184M, fabricated from [ASTM A 615/A 615M, Grade 60 (Grade 420)] [ASTM A 706/A 706M], deformed bars, assembled with clips.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn galvanized steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- H. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain deformed, flat sheet, Type 2 nonbendable coating.
- I. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.
- J. Fiber reinforcing: "Ductal" reinforcing fiber, ultra high performance fiber or approved equal suitable to the mix design.

## 2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
  - 1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
  - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
  - 2. Metakaolin Admixture: ASTM C 618, Class N.
  - 3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
  - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
  - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

- a. Gradation: [Uniformly graded] [Gap graded] [To match design reference sample].
- 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
- D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent.
- E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
  - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
  - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017 M.

## 2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A 283/A 283M.
- D. Malleable Iron Castings: ASTM A 47/A 47M.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.

- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65.
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
- K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
- L. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M
  - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
  - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- M. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply [lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79] [SSPC-Paint 25] according to SSPC-PA 1.
- N. Welding Electrodes: Comply with AWS standards.

## 2.6 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
  - 1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
- C. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

## 2.7 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

## 2.8 GROUT MATERIALS

- A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.
- B. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

## 2.9 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
  - 1. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- A. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- B. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- C. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
  - 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.
- D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- E. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

## 2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
  - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
  - 1. Form joints are not permitted on faces exposed to view in the finished work.
  - 2. Edge and Corner Treatment: Uniformly [chamfered] [radiused].

## 2.11 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
  - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
  - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.

2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
  3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
  4. Place reinforcing steel to maintain at least 3/4-inch (19-mm) minimum concrete cover. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
  5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

- M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

## 2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:
  - 1. Overall Height and Width: Plus or minus 1/8 inch (3 mm).
  - 2. Total Thickness: Plus 1/16 inch (6 mm), minus 1/8 inch (3 mm).
  - 3. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
  - 4. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
  - 5. Local Smoothness: 1/8 inch per 4 feet (6 mm per 3 m).
  - 6. Warping: 1/16 inch per 12 inches (1.5 mm per 300 mm) of distance from nearest adjacent corner.
  - 7. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
  - 8. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
  - 1. Inserts: Plus or minus 1/2 inch (13 mm).
  - 2. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).

## 2.13 FINISHES

- A. General: Finish exposed-face surfaces of precast architectural concrete to match approved finish samples, approved mockup and as follows:



1. Exposed Surfaces shall be free of joint marks, pockets, sand streaks, honeycombs, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp.
2. Finish for all exposed-face surfaces of architectural precast concrete units shall be light acid wash.
3. Color and Aggregate mix according to approved samples. Color Natural concrete with uniform color and texture.
4. Anti-Graffiti Coating: Provide Anti-Graffiti Coating on all exposed surfaces. Include in Sample Panel.

#### 2.14 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- B. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
- C. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting cast-in-place structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

### 3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
  - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected, as needed. Tack weld steel shims to each other to prevent shims from separating.
  - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
  - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
- D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
  - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
  - 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
  - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
  - 4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
  - 5. Remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
  - 1. Where slotted connections are used, verify bolt position and tightness.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

### 3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, true as follows:

1. Maximum Jog in Alignment of Matching Edges: 1/16 inch (6 mm).
2. Joint Width (Governs over Joint Taper): Plus or minus 1/16 inch
3. Maximum Joint Taper: 1/16 inch (10 mm).
4. Maximum Jog in Alignment of Matching Faces: 1/16 inch (6 mm).

### 3.4 FIELD QUALITY CONTROL

- A. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
- B. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

### 3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.

- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
  - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

3.7 ANTI-GRAFFITI COATING: As specified in Section 09910 "Anti-Graffiti Coating – Site"

END OF SECTION 03450

## SECTION 04810

### TILE

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Work includes: Tile and Accessories:
  - 1. Public Art Tile inset at Wall 2 Hillpoint Park – “Stream of Consciousness”. Mosaic tile panels to be provided by owner, and installed by contractor.
  - 2. Setting materials.
  - 3. Miscellaneous masonry accessories.

##### 1.2 RELATED SECTIONS

- A. Section 03300 – Cast In Place Concrete

##### 1.3 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
  - 2. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
  - 3. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
  - 4. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
  - 5. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
  - 6. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
  - 7. ANSI A118.4 - Latex-Portland Cement Mortar.
  - 8. ANSI A118.6 - Standard Ceramic Tile Grouts.
  - 9. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units
  - 10. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
  - 11. ANSI A137.1 - Specifications for Ceramic Tile.
- B. ASTM International (ASTM):
  - 1. ASTM C 50 - Standard Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products.
  - 2. ASTM C 1028 - Standard Test method for Determining the Static Coefficient of Friction on Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.

- C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR PRE-BID  
CMG Landscape Architecture

TILE  
04810-1  
11/10/2014

values as determined by testing in conformance with ASTM C 1028.

## 1.5 SUBMITTALS

- A. Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- B. Shop Drawings: Indicate tile layout, pattern, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details. Prepare shop drawings for each tile application listed under Work Included.
- C. Samples: Color charts illustrating full range of colors and patterns for 3"x3" Infill tile. Color charts illustrating full range of colors for specified grout.
- D. Samples: Samples of 3"x3" Infill tile (actual tiles) for final selection.
- E. Samples: Mount tile and apply grout on hardboard backing, illustrating pattern, color variations, and grout joint size variations. Tile layout sample size: 27" wide x 12" high; refer to shop drawings for Wall 7 Innes Court Park tile layout. Sample board not needed for Work Included in item 3 - Tile inset at Wall 2 Hillpoint Park – "Stream of Consciousness".
- F. Manufacturer's Certificate:
  - 1. Certify that products meet or exceed specified requirements.
  - 2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years experience.
- B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

## 1.8 EXTRA MATERIALS

- A. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed and clearly labeled.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: DalTile Corporation, which is located at: 7834 C.F. Hawn Fwy. P. O. Box 170130 ; Dallas, TX 75217; Toll Free Tel: 800-933-TILE; Tel: 214-398-1411; Fax: 214-309-4584; Email: [todd.lehr@daltile.com](mailto:todd.lehr@daltile.com); Web: [www.daltileproducts.com](http://www.daltileproducts.com)
- B. Requests for substitutions will be considered.

### 2.2 TILE

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
  - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
  - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
  - 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
- B. Wall Glazed Tile:
  - 1. Product: Festiva.
  - 2. Size and Shape: 3 inches square, nominal.
  - 3. Surface Finish: Plain.
  - 4. Colors: As scheduled.

### 2.3 SETTING MATERIALS

- A. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure or Epoxy Adhesive: ANSI A118.3, thinset bond type or approved equal.
- B. Mortar Bed Materials:
  - 1. Portland cement: ASTM C150, type 1, gray or white.
  - 2. Hydrated Lime: ASTM C207, Type S.
  - 3. Sand: ASTM C144, fine.
  - 4. Water: Clean and potable.
- C. Mortar Bond Coat Materials:
  - 1. Dry-Set Portland Cement type: ANSI A118.1.
  - 2. Latex-Portland Cement type: ANSI A118.4.
  - 3. Epoxy: ANSI A118.3, 100 percent solids.
- D. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; color as selected in Schedule.
- E. Epoxy Grout: ANSI A118.8, 100 percent solids epoxy grout; color as selected.
- F. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced with 2 inch (50 mm) wide coated glass fiber tape for joints and corners:

1. Thickness: as shown on Drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.

### 3.2 INSTALLATION - GENERAL

- A. Set ceramic tiles in the layout indicated on approved shop drawings using the latex modified setting bed specified in accordance with TCNA installation method F102. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated.
- C. Align tiles straight and true with variations not exceeding 1/16 inch in length, height or width. Make wide of grout joints consistent throughout.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Fill joints between tiles and between tiles and adjacent surfaces with grout finished flush with face of tiles. Damp cure grout for 3 days minimum.

### 3.3 INSTALLATION - WALL TILE

- A. Over cementitious backer units install in accordance with TCA Handbook Method W223, organic adhesive.

### 3.4 CLEANING

- A. Clean tile and grout surfaces.

### 3.5 SCHEDULE

- A. 3" x 3" Infill tile at Wall 7 Innes Court Park
  1. Tile Color: Dal Festiva Spa Blue or approved equal.
  2. Grout Color: Avalanche by Mapei or approved equal.

END OF SECTION



SECTION 05501  
SITE METAL FABRICATIONS

PART 1 - GENERAL

1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2 SUMMARY

- A. This Section includes the following:
1. Handrails at Stairs
  2. Armrests at Precast "Pinto" Benches
  3. Backrest at "Raft" Bench
  4. Other miscellaneous
- B. Related Sections include the following:
1. Section 02775 –Concrete Paving
  2. Section 03300 – Cast In Place Concrete
  3. Section 03450 - Architectural Precast Concrete

3 SUBMITTALS

- A. Product Data: For the following:
1. Paint products.
  2. Grout.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
1. Provide templates for anchors and bolts specified for installation.
- C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.

- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### 4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Mock-ups:
  - 1. Representative frame pieces to demonstrate all weld conditions and connections. Include galvanized finish as per specifications for final product.

#### 5 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

#### 6 COORDINATION

- 1. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 1 SITE METAL FABRICATIONS

- A. This Section includes the following:
  - 1. Handrails
  - 2. Armrests at Precast "Pinto" Benches
  - 3. Backrest at "Raft" Bench
  - 4. Other miscellaneous
- B. See Drawings.

### 2 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

### 3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

### 4 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664;

selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

- B. Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Carboline 621; Carboline Company.
    - b. Aquapon Zinc-Rich Primer 97-670; PPG Industries, Inc.
    - c. Tneme-Zinc 90-97; Tnemec Company, Inc.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

## 5 FASTENERS

- A. General: Provide Type 316 stainless-steel fasteners for exterior use. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
- I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

## 6 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 7 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 8 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

## 9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items after fabrication as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
  1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

## 2 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  - 1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.
  - 1. Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

## 4 INSTALLING SITE METAL FABRICATIONS

- A. Install as indicated in Drawings.



## 5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

## SECTION 09965

### GRAFFITI-RESISTANT COATINGS

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Graffiti-resistant coating to protect all exposed exterior non-traffic bearing concrete and precast concrete surfaces.

##### **1.2 RELATED SECTIONS**

- A. Section 03330 – Cast In Place Concrete: Concrete substrate material to receive graffiti resistant coating.
- B. Section 03450 – Architectural Precast Concrete – Site: Concrete substrate material to receive graffiti resistant coating.

##### **1.3 REFERENCES**

- A. ASTM D5095 – Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments.

##### **1.4 PERFORMANCE REQUIREMENTS**

- A. Graffiti-resistant coating to allow complete removal of every type of paint and graffiti material without damaging uncoated surface to which coatings are applied.
- B. Graffiti-resistant coating and products recommended by coating manufacturer to remove graffiti to be non-toxic and comply with requirements of local air quality management district.
- C. Graffiti-resistant coating to be weather and rain resistant, abrasive resistant, peel resistant, ultra-violet resistant, non-yellowing and allow vapor transmission.
- D. Products recommended by coating manufacturer to remove graffiti from coated surface to permit removal of graffiti with little or not change in appearance of treated surface.

##### **1.5 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data sheets for every product used. Include description for protection of surrounding areas and non-concrete and non-masonry surfaces; surface preparation, application and final cleaning.

B. Certifications:

1. Applicator Qualifications: Certify that applicator is experienced in application of specified products. Include list of recently completed graffiti-resistant coatings projects listing project name, names of owner and architect, products used, substrates, applicable local environmental regulations, and application procedures.
2. VOC Regulations: Certify that graffiti-resistant coatings furnished comply with regulations controlling use of volatile organic compounds.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's recommendations for graffiti removal products and procedures. Include material specifications and instructions for application.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of graffiti-resistant coatings with minimum 10 years documented experience.
- B. Applicator: Company specializing in application of graffiti-resistant coatings with minimum 5 years documented experience and employing persons experienced in application of specified products.

1.8 REGULATORY REQUIREMENTS

- A. Conform to regulations of Bay Area Air Quality Management District and California Air Resources Board.

1.9 FIELD SAMPLES

- A. Before full-scale application, review manufacturer's product data sheets to determine suitability of each product for specific surfaces. Apply graffiti-resistant coating to test panels to determine number of applications, coverage rates, compatibility, effectiveness, surface preparation, application procedures and desired results.
- B. Apply graffiti-resistant coating to test panels in accordance with manufacturer's written instructions. Allow 48 hours or until test panels are thoroughly dry before evaluating final appearance and results.
- D. Do not begin full-scale application until test panels are reviewed and accepted by Architect.
- E. Test Panel Requirements:
1. Size: Minimum 4 x 4 feet.
  2. Locations: As determined by Architect.

3. Number: As required to completely test graffiti-resistant coating with each type of substrate to be protected.
- F. Retain and protect test panels accepted by Architect in undisturbed condition during work of this section. Accepted panels will be used to establish standard for work of this section.
- 1.10 PREINSTALLATION CONFERENCE
- A. Schedule preinstallation conference minimum 1 week prior to beginning work of this section.
  - B. Attendance: Contractor, graffiti-resistant coating applicator, graffiti-resistant coating manufacturer's representative, Project Manager, Project Inspector and Architect.
  - C. Agenda: Review environmental regulations, test panel procedures, protection of surrounding areas and non-masonry surfaces, surface preparation, application, field quality control, final cleaning and coordination with other work.
- 1.11 DELIVERY, STORAGE AND HANDLING
- A. Deliver products to site, store, handle and protect in accordance with manufacturer's instructions and recommendations.
  - B. Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly identifying product name and manufacturer.
  - C. Store and handle materials in accordance with manufacturer's instructions.
    1. Store containers upright in cool, dry, well ventilated place out of sun. Maintain temperature between 45 degrees F and 100 degrees F.
    2. Store containers away from other chemicals and potential sources of contamination.
    3. Do not drop containers or slide across sharp objects.
    4. Do not double stack pallets.
    5. Keep containers tightly closed when not in use.
- 1.12 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply graffiti-resistant coatings at surface and air temperatures below 40 degrees F or above 95 degrees F unless otherwise indicated by manufacturer's written instructions.

- B. Do not apply graffiti-resistant coatings when surface and air temperatures are not expected to remain above 40 degrees F and below 95 degrees F for minimum 8 hours after application unless otherwise indicated by manufacturer's written instructions.
- C. Do not apply graffiti-resistant coatings under windy conditions such that coating may be blown to surfaces not intended to be treated.
- D. Do not apply graffiti-resistant coatings to frozen substrate. Allow adequate time for substrate to thaw if freezing conditions exist before application.
- E. Do not apply graffiti-resistant coatings earlier than 24 hours after rain for if rain is predicted for a period of 6 hours after application unless otherwise indicated by manufacturer's written instructions.

#### 1.13 COORDINATION

- A. Coordinate application of graffiti-resistant coating with installation of finish paving, planting and other site features specified under Section "Cast In Place Concrete," Section "Site Furnishings," and Section "Architectural Precast Concrete." Ensure graffiti-resistant coating is applied prior to installation of finish paving, planting and other site features.

## PART 2 PRODUCTS

### 2.1 GRAFFITI-RESISTANT COATING

- A. Manufacturers:
  - 1. ProSoCo, Inc.: SureKlean® Weather Seal Blok-Guard® & Graffiti Control II.
  - 2. Substitutions: Under provisions of Division 1.
- B. Coating: Clear-drying water-based emulsion for weatherproofing and protecting concrete and masonry surfaces from graffiti attacks without altering natural appearance; non-sacrificial; UV stable; breathable; matte finish as approved by Landscape Architect.
  - 1. Form: Milky white liquid.
  - 2. Specific Gravity: 1.00.
  - 3. Weight per Gallon: 8.32 lbs.
  - 4. Active Content: 6 percent.
  - 5. Total Solids: 6 percent in accordance with ASTM D5095.
  - 6. Flash Point: >212°F.

7. Freeze Point: 32°F.
8. VOC Content: 14 g/L.
9. Shelf Life: 1 year in tightly sealed unopened containers.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine condition of substrates to determine acceptability for installation. Verify that substrates are acceptable for product installation in accordance with manufacturer's instructions and recommendations.
  1. Verify that surfaces are free from cracks, voids, defects and other damage.
  2. Verify that joints have been sealed and that sealant is completely cured.
  3. Verify that substrate surface has completely cured.
- B. Do not begin application until unsatisfactory conditions have been corrected.

#### **3.2 PROTECTION**

- A. Protect surrounding areas, landscaping, building occupants, pedestrians, vehicles and non-concrete and non-masonry surfaces not designated for protection during work from contact with product, splash, residue, fumes and wind drift in accordance with manufacture's written instructions.
- B. Mask windows, curtain wall, doors and door frames with polyethylene film or other proven protective material.
- C. Fill cracks and voids to prevent penetration of fumes into buildings.
- D. Divert and protect pedestrian and auto traffic.

#### **3.3 PREPARATION**

- A. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of graffiti-resistant coatings from surfaces to be treated.
- B. Use appropriate cleaners approved by coating manufacturer where necessary.
- C. Rinse thoroughly using pressure water spray to remove cleaner residues. Allow surfaces to dry completely before application of graffiti-resistant coating.

### 3.4 APPLICATION

- A. Apply graffiti-resistant coating to substrates in accordance with manufacturer's written instructions, environmental regulations and application procedures determined from field samples.
- B. Apply as packaged; do not dilute or alter.
- C. Apply to clean, dry, cured and properly prepared surfaces using equipment and precautions stipulated in manufacturer's written instructions. Apply 'wet-to-wet' to visibly dry and absorbent surface.
  - 1. Spray Application:
    - a. Saturate form bottom up. Let first application penetrate for 2 to 3 minutes; resaturate.
    - b. Spray fluted precast concrete surfaces in overlapping "X" pattern to ensure complete coverage of recessed surfaces.
  - 2. Brush or Roller Application:
    - a. Saturate uniformly. Let first application penetrate for 2 to 3 minutes; resaturate.
    - b. Brush out heavy runs and drips that do not penetrate substrate.
- D. Apply in manner to prevent overspray, wind drift and splash.

### 3.5 FIELD QUALITY CONTROL

- A. Inspect graffiti-resistant completed coating work with Project Manager, Project Inspector, Architect, applicator and manufacturer's representative; compare with accepted field samples to determine if substrates are suitably protected by graffiti-resistant coating.
- B. Correct deficiencies in coatings as directed by Architect and in accordance with recommendations of manufacturer's representative.

### 3.6 CLEANING

- A. Remove overspray from adjacent surfaces not designated to receive graffiti-resistant coating using materials and methods recommended by coating manufacturer and acceptable to manufacturer and fabricator of adjacent surface.
- B. Repair, restore or replace, to satisfaction of Project Manager and Architect, materials and landscaping that cannot be successfully cleaned and are damaged by exposure to graffiti-resistant coatings.

- C. Clean site of unused graffiti-resistant coatings, residues, rinse water, wastes and effluents in accordance with environmental regulations. Remove and dispose of materials used to protect surrounding areas and non-masonry surfaces.

### 3.7 SCHEDULE

- A. Site Concrete: Apply graffiti-resistant coating to exposed surfaces of exterior architectural cast-in-place site concrete and architectural precast site concrete other than paving surfaces.

END OF SECTION



SECTION 16009  
SITE - CONDUIT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes all conduit and cables sleeves on the site systems as indicated on the drawings and required for a complete and operable electrical system.
- B. All conduits and equipment shall meet the requirements of the site environment.
- C. Related work specified in other sections:
  - 1. Section 16050: Electrical Material and Methods
  - 2. Section 16010: Electrical Generation Revisions
  - 3. Section 16526: Street Lighting

1.2 QUALITY ASSURANCE

- A. As specified in Section 16010: Electrical General Provisions

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit, galvanized, with 40 mil PVC coating.
- B. Polyvinylchloride (PVC) Conduit
  - 1. PVC conduit of standard Schedule 40 pipe dimensions.
  - 2. PVC conduit of standard Schedule 80 pipe dimensions.
- C. Polyvinylchloride (PVC) Conduit.
- D. Flexible Conduit, liquid-tight, non-metallic (Carlson "Car-flex" or approved equal).
- E. Electrical Metallic Tubing.
- F. Rigid Steel Conduit, galvanized.

## PART 3 - EXECUTION

### 3.1 RACEWAY

- A. All underground service raceways except as noted on the drawings shall be PVC, Schedule 80, with rigid steel elbows and risers to grade.
- B. For mechanical protection: Schedule 80 PVC.
- C. Exposed conduit on buildings shall be galvanized Rigid Steel Conduit.

### 3.2 CONDUIT IDENTIFICATION

All underground conduits shall be identified with self-adhering vinyl markers that have preprinted lettering to identify the ownership or use of the individual conduits, such as SFPUC, DPW, DPT, DTIS, Street Light, etc. Markers shall have factory applied pressure sensitive adhesive and shall be made of vinyl material that is of a type and thickness suitable for underground service in the types of soil and subsurface conditions encountered in the project area. Markers shall have white background with bright orange lettering, and shall be placed on top of conduits at a maximum of 20-foot intervals. Markers shall be 2 inches wide by 14 inches long. Lettering on the markers shall be 1.5 inches high and in an easily readable font. In addition, the ends of conduits (only those to be used in the future) in manholes, pull boxes, etc., shall be tagged using legible and durable 2-inch diameter brass metal tags stamped with the applicable ownership identification as stated above."

"Lettering shall be a minimum of 0.25 inches high. Tags shall be affixed to both ends of all such conduits with a non-corroding durable metal wire or other suitable and long lasting method. Submit two samples of vinyl markers and tags to the City for acceptance."

Following installation, each conduit shall be cleaned and tested for clearance by pulling a mandrel through its length in the presence of the conduit occupant's inspector, who shall be given 24-hour notice prior to the cleaning. Documentation and measurements shall be taken and provided to the conduit occupants in accordance with their requirements.

### 3.3 CONDUIT INSTALLATION

- A. General Requirements: Cut conduit ends square and ream smooth. Install coated steel conduit and fittings in accordance with manufacturer's instructions, taking all precautions not to damage coating and repairing damaged coating immediately. Use factory approved bonding compound for PVC conduits and duct.
- B. Conduit Sleeves:
  - 1. Provide sleeves as indicated on the drawings and as required for conduits and cables.
  - 2. Sleeves shall be sized as indicated on the drawings, but in no case

sized smaller than what is adequate to provide 1/4" clearance between sleeve and conduit or cables.

C. Fittings and Terminations:

1. Fittings shall be constructed materials of the same type, size and finish as the conduit on which installed.
2. Furnish expansion fittings where raceways cross expansion joints.
3. Conduit shall be sealed where entering or leaving spaces having ambient temperature differentials of 10°F or greater.
4. All terminated conduit must be measured, end to end, and the lengths included in the "As-Builts".

D. Supports:

1. Support raceways by means of brackets or straps spaced not more than allowed by the NEC. Supports shall be secured by means of toggle bolts, expansion bolts or inserts in concrete. The conduit shall be allowed to slip in either direction for expansion.
2. No conduit shall rest on or be supported by any mechanical piping, etc.
3. Provide additional supports at junction and outlet boxes when conduit is used to support other electrical equipment, as indicated in NEC.

E. Underground Conduit:

1. Where indicated on the drawings or herein specified, install underground conduit with a minimum spacing of 3" between adjacent conduits.
2. All underground conduits shall confirm to PG&E requirements.
3. All underground conduits shall be identified with self-adhering vinyl markers that have preprinted lettering to identify the ownership or use of the individual conduits, such as SFPUC, DPW, DPT, DTIS, Street Light, etc. Markers shall have factory applied pressure sensitive adhesive and shall be made of vinyl material that is of a type and thickness suitable for underground services in the types of soil and subsurface conditions encountered in the project area. Markers shall have white background with bright orange lettering, and shall be placed on top of conduits at a maximum of 20 foot intervals. Markers shall be 2 inches wide by 14 inches long. Lettering on the markers shall be 1.5 inches high and in an easily readable font. In addition, the end of conduits (only those to be used in the future) in manholes, pull boxes, etc., shall be tagged using legible and durable 2-inch diameter brass metal tags stamped with the applicable ownership identification as stated above.

Lettering shall be a minimum of 0.25 inches high. Tags shall be affixed to both ends of all such conduits with a non-corroding durable metal wire or other suitable and long lasting method. Submit two samples of vinyl markers and tags to the City for acceptance.

4. Following installation, each conduit shall be cleaned and tested for clearance by pulling a mandrel through its length in the presence of the conduit occupant's inspector, who shall be given 24 hour notice prior to the cleaning. Documentation and measurements shall be taken and provided to the conduit occupants in accordance with their requirements.

F. Minimum Conduit Size:

1. Minimum size of underground conduit shall be 1" unless noted otherwise on the drawings.

G. Grounding:

1. Provide ground wires in nonmetallic conduits.
2. Provide separate code sized green ground wire in all power branch circuit feeders.

H. Pulling Wire and Pulling Tape:

1. Install a minimum of 200 lb test polypropylene yellow cord in all conduits.
2. Provide pull tape, with at least 3 feet of slack at each end of conduit.

I. Mandrels and Conduit Cleaning:

1. Immediately following backfill and the required compaction, a testing mandrel shall be drawn.
2. The diameter of the mandrel shall not be VI" less than the interior size of each, conduit.
3. The mandrel shall be drawn through each conduit.
4. A brush equipped with stiff wire bristles shall be drawn repeatable through the conduit until the conduit is clear of all particles, including earth, sand, and gravel.

J. Duct Plugs:

1. Duct plugs shall be removable, reusable, corrosion proof, watertight, airtight, and gas tight.
2. During construction, conduits of partially completed ducts shall be protected from debris by means of suitable temporary plugs.

K. Conduit Protection:

1. Conduits terminating in manholes or pullboxes shall be plugged after successful testing, installation of pull lines, and completion of conduit

installation.

2. Install marking tape three (3) inches wide over the non-metallic conduit. Tape - - Formatted: Bullets and Numbering 1 shall be red, continuously imprinted with, "CAUTION – ELECTRIC LINE BURIED BELOW" or similar approved legend

### 3.4 SPECIAL INSTALLATION REQUIREMENTS

- A. Polyvinylchloride Conduit:
  1. Only standard factory bends may be used, no field bending of conduit if radius is less than 80'.
  2. Make all bends by means of electrical heating unit approved by conduit manufacturer.
  3. Minimum sweep for 4" conduit is three (3) feet 90 degree radius.
  4. Minimum sweep for 6" conduits shall be 36" vertical and 60" horizontal.
  5. Bends, sweeps or grade changes that have a radius of 80' or less or a grade change of 20% or more must be encased in 2500 psi concrete
  6. Provide a code sized equipment ground conductor in all PVC raceways, in accordance with NEC.
  7. Install PVC conduit in strict accordance with manufacturer's recommendations.
  8. Convert to steel conduit by means of adapters when entering, emerging from slab, etc.
  9. Where applicable, install 45 and 90 factory elbows on-long runs. Install reinforcing concrete collar for additional raceway strength.
- B. Pull Boxes:
  1. Boxes are to be ordered with the appropriate number of knockouts or terminators to accommodate the conduits.
  2. Supply vaults with cast-in-place terminators for all conduits.
  3. Terminate conduits entering structures through cored holes and provide end-bells neatly grouted in place. Install terminators and end-bells flush with the interior walls unless otherwise shown or noted. Stagger the joints of the conduit rows and layers to provide maximum strength to the duct lines.
  4. Provide primary underground equipment enclosures with the following:
    - a. Standard pulling irons
    - b. 14" diameter sump
    - c. Vertical Unistrut "C" channels for attaching racks along walls.

END OF SECTION

SECTION 16010  
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DEFINITIONS (APPLICABLE TO DRAWINGS AND SPECIFICATIONS)

- A. Above Grade: Not buried in ground and not embedded in concrete slab on grade.
- B. Below Grade: Buried in ground or embedded in concrete slab on grade.
- C. Concealed: Inside building above grade and located within walls, furred spaces, crawl spaces, attics, above suspended ceilings, etc. In general, any item not visible or directly accessible.
- D. Connect: Complete hookup of item with required services, including conduit, wires and other accessories.
- E. Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as mechanical and storage rooms. In general any item that is directly accessible without removing panels, walls, ceilings, or other parts of structure.
- F. Furnish: Supply and deliver complete.
- G. Install: Place, secure and connect as required to make fully operational.
- H. Provide: Furnish and install as defined above; perform work
- I. Underground: Buried in ground, including under building slabs.
- J. Use (verb): Furnish and install as defined above.
- K. Wiring: Electrical raceway, conductors and connections.

1.2 SCOPE OF WORK

- A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 16 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation including all accessories and appurtenances required for testing the system. It is the intent of the contract documents that all systems be complete and ready for operation.

1.3 CODE COMPLIANCE

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
GHD

ELECTRICAL  
GENERAL PROVISIONS  
16010-1  
11/10/2014

- A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to the following
1. Occupational Safety and Health Act Standards (OSHA).
  2. NFPA #70 – National Electric Code (NEC) 1999.
  3. NFPA #101 – Life Safety Code.
  4. City of San Francisco Electric Code 1999.
  5. Regulations of City and County of San Francisco Bureau of Light, Heat, and Power (BLHP).
  6. California Code of Regulations Title 8, Chapter 4, Subchapter 5, Electrical Safety Orders.
  7. Rules for Overhead Line Construction, General Order No. 95, California Utilities Commission.
  8. All other applicable Federal, State and local laws and regulations including GO128.
  9. Standard Plans and Standard Specifications: City and County of San Francisco, Department of Public Works, Bureau of Engineering.
- B. Code compliance is mandatory. Nothing in these contract documents permits work not conforming to these codes. Where work is shown to exceed minimum code requirements, the Contractor shall comply with drawings and specifications.
- C. No work shall be concealed prior to inspection and approval by Owner's Agent and proper authorities. If work is concealed without inspection and approval, the Contractor shall be responsible to reopen and restore the concealed areas, in addition to all required modifications.

#### 1.4 LICENSE, FEES AND PERMITS

- A. The Contractor shall arrange for required inspections and secure all license, permit and inspection. See Construction Agreement.

#### 1.5 CONDITIONS AT SITE

- A. A site visit is required of all bidders prior to submission of bid. All bidders will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

- B. Facilities of other Utilities that are damaged as a result of this work shall promptly be repaired to the complete satisfaction of the respective Utility Company at no expense to the Owner.

## 1.6 DRAWINGS AND SPECIFICATIONS

- A. All drawings and all Divisions of these specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.
- B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by civil and structural conditions of the job. Consult all other drawings. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included, in the contract cost.
- C. The right is reserved to make a change up to ten feet in location of any outlet or equipment prior to rough in without increasing contract cost.

## 1.7 SAFETY AND INDEMNITY

- A. Safety: The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. See also Construction Agreement.
- B. No act, service, drawing review or construction review by the Owner, or their Consultants is intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

## 1.8 RECORD DRAWINGS

- A. The Contractor shall submit scaled drawing(s) prior to installation of any proposed modifications to equipment layouts, device locations, conduit routing, or conductor groupings. Any approved modifications will be reissued to the Contractor as either a change order or clarification depending on value to the contract. The Contractor shall provide record reproducible mylars of Contract Drawings at close of project incorporating all changes to the documents.

## PART 2 - PRODUCTS

### 2.1 MATERIAL APPROVAL

- A. The design, manufacture and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE and ANSI standards.



- B. All materials must be new and bear the U.L label where applicable. Materials that are not covered by U.L. testing standards shall be tested and accepted by an independent testing laboratory or a governmental agency acceptable to the Owner's Agent

## 2.2 SUBMITTALS, SHOP DRAWINGS AND MATERIALS LIST

- A. The Contractor shall submit shop drawings and product descriptive literature as specified for review. Quantity and procedure for submittals shall be as specified in Construction Agreement.
- B. Material list shall only include items where a specific manufacturer is shown in the specifications. Where manufacturers are shown, material list shall include only one manufacturer for each type of equipment or system.
- C. Purpose of review of submittals is for check of general compliance with information given in contract documents. Each review and/or addition of notations and comments does not relieve Contractor from compliance with requirements of project contract documents.
- D. All proposed deviations from specifications shall be clearly listed under a prominent heading entitled "DEVIATIONS" for review by the Owner's Agent. Deviations not so listed may be disallowed before or after installation of equipment.
- E. Contractor shall be responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, and techniques of construction. Where dimensions of proposed equipment differ significantly from that shown on contract documents, Contractor shall submit scaled drawings showing proposed layout of equipment with shop drawing submittal.

## 2.3 DELIVERY, STORAGE AND HANDLING OF MATERIALS AND EQUIPMENT

- A. All materials shall be delivered, stored and handled in a manner to prevent damage.
- B. Equipment shall be protected from weather and dampness.

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

- A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B. A foreman shall be in charge of this work at all times.

### 3.2 COORDINATION

- A. The work shall be coordinated with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. The Contractor shall inform Contractors of other trades of the required access to clearances around electrical equipment to maintain serviceability and code compliance.
- B. The Contractor shall verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work.
- C. The Electrical Contractor shall participate in the preparation of coordination drawings, which are to be used by all trades for work coordination prior to start of any work. As a minimum Electrical Contractor shall furnish all necessary information, which are related to the size, elevation, routing, clearance requirement, etc. of electrical equipment and are connected under Division 16, to the General Contractor prior to installation of work. Special attention shall be given to areas containing work of many trades.

### 3.3 MANUFACTURER'S INSTRUCTIONS

- A. Where the specifications call for an installation to be made in accordance with manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's Agent.
- B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Owner's Agent before starting work.

### 3.4 QUALITY ASSURANCE

- A. The Contractor shall provide a meaningful Quality Assurance program. To assist the Contractor in this program, the specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other Quality Assurance measures to obtain a complete operating facility within the scope of this project.
- B. The Contractor shall insure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

### 3.5 CUTTING AND PATCHING

- A. The Contractor shall provide all cutting and patching required for work of this Division. Coordination with General Contractor and other trades is imperative. The Contractor shall bear the responsibility for and the added expense of adjusting for improper holes, supports, etc.

### 3.6 FIELD TEST AND OPERATIONAL CHECK

#### A. General Scope

- 1. The Contractor shall perform the inspections and tests to determine the suitability for energization.
- 2. It is the intent of these tests to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

#### B. Failure to Meet Test

- 1. Any system material or workmanship, which is found defective on the basis of acceptance tests, shall be reported directly to the Owner's Agent.
- 2. Contractor shall replace the defective material or equipment and repeat the tests until the tests prove satisfactory, without additional cost to the Owner.

### 3.7 ACCEPTANCE DEMONSTRATION

- A. Upon completion of the work, at a time to be designated by the Owner's Agent, the Contractor shall demonstrate for the Owner's Agent the operation of the installation, including any and all special items installed by him or installed under his supervision. Allow 16 hours of demonstration time.
- B. This demonstration by the Electrical Contractor is in addition to the "Start-Up" service to be provided by the manufacturers specified in the specific sections of Division 16.

### 3.8 SERVICES REQUIRMENT

- A. Contractor shall coordinate with PG&E to provide electrical service for the project.

END OF SECTION

## SECTION 16050

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- L. Work included in this Section are conduits, wires, other miscellaneous materials not specifically mentioned in other Sections of Division 16, but necessary or required for equipment or system operation or function, and the labor to install them.
- M. Related work included in other Sections: All other Sections of Division 16.

##### 1.2 INCORPORATED DOCUMENTS

- A. Section 16010, Electrical General Provisions, applies to this Section.

##### 1.3 SUBMITTALS

- C. See Section 16010, "Electrical General Provisions".
- D. The Contractor shall submit manufacturer's descriptive literature of each item proposed for use.
- E. The Contractor shall provide a sample of each item proposed for use where specified in the contract documents.

#### PART 2 - PRODUCTS

##### 2.1 CONDUITS AND OTHER RACEWAYS

- A. Rigid Steel: Hot dipped galvanized.
- B. Plastic:
  - 1. Schedule 40PVC, approved for use as non-metallic raceway for 90° C conductors. Carlon, Certain Teed, or Kraloy.
  - 2. Schedule 80 extra heavy wall PVC.
  - 3. High-Density Polyethylene (HDPE) with self-extinguishing additive, and conforming to UL requirements.
- C. Provide fittings and accessories approved for the purpose and equal in all respects to the conduit or raceway.

## 2.2 CONDUCTORS AND CABLES

- A. For power and lighting systems 600V or less:
  - 1. Conductors #12 and #10 AWG shall be solid copper, conductors #8 AWG and larger shall be stranded copper.
  - 2. Insulation for #12 to #1 AWG: shall be Type THW for all locations.
- B. Manufacturers:
  - 1. For conductors #4 AWG and larger: General Electric, Anaconda, Okonite, Paranite, Cyprus-Rome, Pirelli-General or Triangle products conforming or exceeding applicable IPCEA standards.
- C. For Street Lighting Systems:
  - 1. #10 AWG street lighting conductors shall be solid copper and #8 AWG or larger conductors shall be stranded copper, rated for 600 volt operation with Type THW insulation. Conductors shall be of the following sizes:  
All field or through conductors: #8 AWG minimum.  
Wiring inside street lighting pole: #10 AWG minimum.

## 2.3 CONNECTORS AND SPLICING

- A. For conductors #8 AWG and smaller, splice connectors shall be insulated pressure type (with live spring), rated 105 degree C, 600V, for building wiring and 1000V in signs or fixtures, 3M Scotchlok or Ideal. All underground splices shall be waterproof.

## 2.4 HANDHOLES or PULL BOXES AND VAULTS

- A. Handholes Pull boxes shall be of the sizes indicated or noted on the plans and shall be sized of the pre-cast concrete type, each provide with a structurally reinforced traffic-type, bolt-down, galvanized steel cover and required extension collar. All covers shall be identified as to service, such as traffic signal, street lighting etc. Pull boxes shall be Brooks, Christy or Quickset.
- B. Vaults and manholes shall be of the sizes as indicated or noted on the plans. Pre-cast concrete structurally reinforced traffic-type, with bolt-down, galvanized steel cover, required extension collars, sumps, grounding and pulling hardware as to comply with requirements of Utility companies such as Pacific Gas and Electric company, AT&T, Pacific Bell, and RCN etc. All covers shall be identified with their company label with service type, such as PG&E, AT&T, traffic signal, power, telephone, communication etc.

- C. Handholes, Pull boxes, manholes and vaults shall be left in a clean condition with all debris removed

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Electrical system layouts indicated on the drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit. The exact routing of conduits, cable and wiring and the locations of pull boxes, vaults, outlets and light standards shall be governed by the site condition, the structure and the equipment served. Dimensions included in the drawings shall be adhered to.
- B. The joint trench layout indicated on drawings is diagrammatic. Contractor shall make all necessary field changes to accommodate with field condition. Provide all necessary work for offsets, change of direction and elevations to avoid conflicts with other divisions and existing facilities. Joint trench details, which are shown on drawings, are typical for reference only. Contractor shall provide shop drawings and trench configurations to Owner agents and City and County of San Francisco for review and approval prior to issuance of permit for construction.
- C. Contractor shall provide all pipe bores for conduit passing through railroad track or Muni trackways. All pipe bore details shall conform to Caltrans Standards and approved by City and County of San Francisco.
- D. All other relevant drawings shall be consulted. Verify all scales and report any dimensional discrepancies or other conflicts to Owners Agent before starting work.

### 3.2 WIRING METHOD

- A. Install all wiring in raceway, unless specifically noted otherwise.
- B. Sizes of conduits, unless specifically noted otherwise, shall be determined from NEC Table 3A for conductors #16 through #4/0 AWG and NEC Table 3C for conductors 250 MCM or larger, both from Chapter 9 of latest National Electric Code.

### 3.3 INSTALLATION OF CONDUITS

- A. General
  - 1. All conduits shall be installed concealed unless otherwise noted or shown.

2. Run no conduit in concrete slabs or floors except at point of penetration. All penetrations shall be at right angles to slab surfaces.
3. Provide pull boxes where shown or as required to limit any conduit run to a maximum of three 90 degree bends (or equivalent) unless otherwise noted, avoid "U" bends.
4. Minimum conduit size shall be 1 ½" unless otherwise noted on drawings.
5. Conduit shall be installed 24" minimum below in the roadway area and 18" minimum below in the sidewalk area. Coordinate with other divisions and existing facilities for bury depth. See drawings for other information.
6. Underground conduit entering building or penetrating finished grade, shall be provided with one 10' section of rigid steel conduit at point of penetration of foundation, footing, concrete structure, or finished grade, with approximately equal lengths inside and outside building line.
7. Pull boxes shall be provided at a minimum spacing of 200 feet and where shown on the plans or per requirements of each utility company, communication service provider or City and County of San Francisco.

B. For Street Lighting

1. All conduits shall be rigid steel.
2. The maximum number of bends in any conduit run shall be as follows:
  - a. A run of conduit between the bases of standards and controller pedestals shall not contain more than the equivalent of two 90° and one 45° bends.
  - b. A run of conduit between pull boxes or junction boxes shall not contain more than the equivalent of three 45° degree bends.
  - c. A run of conduit between the base of a standard or controller pedestal and pull or junction box shall not contain more than the equivalent of one 90° and one 45° bends.

### 3.4 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conductors and cables shall not be pulled into any portion of the conduit system until all conduit installation work has been completed and inspected by authorized agents.
- B. All conductors and cables shall be installed continuously from terminal to terminal. Splices in cables shall be made only in pull boxes, cabinets or where shown on the plans.

- C. Splices in conductors and cables shall be made utilizing materials and methods as indicated in the Contract Documents.
- D. All conductors and cables passing through manholes and handholes shall be full-looped inside the manholes or handholes and supported on galvanized steel racks.

### 3.5 CONDUCTOR COLOR CODE

- A. All conductors shall be color coded. Wire sizes #8 AWG or smaller shall have integral color coded insulation. Wire sizes #6 AWG and larger may have black insulation but shall be identified by color-coded electrical tape at all junction, splice, pull, or termination points. Color-coding tape shall be applied ½ lap to at least 6" of the conductor.
- B. Conductors shall be color coded as follows:

| <u>Conductors</u> | <u>120/240 Volts</u> |
|-------------------|----------------------|
| Phase A           | Black                |
| Phase B           | Red                  |
| Neutral           | White                |
| Ground            | Green                |

### 3.6 CONNECTIONS TO STREET LIGHTING STANDARDS

- A. The necessary conduit and wiring shall be furnished and installed to provide electrical power to all street lighting standards and fixtures.

### 3.7 CONCRETE AND CONCRETE WORK

- A. Concrete shall conform to requirements of Section 03300 – Cast-in-Place Concrete. Minimum 28-day strength shall be 3000 psi.

### 3.8 EXCAVATION AND BACKFILL

- A. All excavation and backfill required because of this work shall be included. Excavation of trenches shall be sequenced to minimize "open time" and inconvenience.
- B. Trenches shall be cut straight and true and shall be shored and braced where required. See Section 02225, "Excavation, backfilling, and compacting for utilities".

END OF SECTION



## SECTION 16113

### UNDERGROUND SLAB AND UNDERGROUND ELECTRICAL WORK

#### PART 1 - GENERAL

##### 1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to the General Conditions, Supplementary General Conditions and Division I General Requirements.
- B. Related work specified in other sections:
  - 1. Section 02225: Excavation, Backfilling and Compacting for Utilities
  - 2. Section 03300: Cast-in-place concrete
  - 3. Section 16010: Electrical General Provisions
  - 4. Section 16050: Electrical Materials and Methods

##### 1.2 DESCRIPTIONS

- A. Work included in this Section: Under slab conduits and related electrical work

##### 1.3 INCORPORATED DOCUMENTS

- A. Section 16010, Electrical General Provisions, applies to all work in this Section.

##### 1.4 SUBMITTALS

- A. Manufacturer's literature describing the product.

#### PART 2 - GENERAL

##### 2.1 CONDUIT

- A. All shall be provided with fittings and accessories approved for the purpose and equal in all respects to conduits:
  - 1. Rigid Steel: Hot-dipped galvanized or sherardized.
  - 2. Plastic: PVC Schedule 80, approved for use as a non-metallic raceway for 90-degree C. conductors. Carlon, CertainTeed or Kraloy.
  - 3. Conduits for traffic signals shall be Schedule 80 and shall be accordance with Section 02890.

##### 2.2 PRE-CAST CONCRETE, MANHOLE

- A. Structural reinforced, size as indicated, with inserts for cable racks, spring loaded hinges, pull eyes, permanent label on cover "ELECTRICAL", "TELEPHONE", "SIGNAL" "PG&E" OR "PAC. BELL", "TV", and other utility companies' requirement to suit the specific system.

## 2.3 BARE COPPER GROUND CONDUCTORS

- A. Medium hard drawn copper conductor, #410 AWG stranded.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Electrical system layouts indicated on the drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit.
- B. Consult all other drawings. Verify all scales and report any dimensional discrepancies or other conflicts to Architect before submitting bid.

### 3.2 CONDUIT INSTALLATION

- A. Provide 2" sand base in rock base area. Multiple conduit runs shall maintain 3" minimum separation between conduits unless otherwise shown or noted.
- B. Plastic conduit 1.5" size and similar shall be installed on 2' sand base and covered by 2" sand fill. Multiple runs shall maintain 3' minimum separation between conduits.
- C. Underground conduit entering building shall be provided with a 10' section of rigid steel conduit at point of penetration of foundation, footing, building footprint perimeter, or basement wall, with approximately equal lengths inside and outside building line. Ream the smaller inside diameter conduit smooth to prevent conductor damage.
- D. Provide rigid steel elbows below grade and rigid steel conduit riser to 6" above finished floor
- E. Stagger conduit couplings by minimum of 12". All risers to grade shall be rigid steel.
- F. After completion of underground or under slab duct system a 12" mandrel, 1/4" less in diameter than the conduit shall be pulled through each conduit.
- G. Install 1/8" diameter Tubbs Cordage Company "yellow polyline" or per

utility companies' specified pull line in each underground conduit.

- H. If joint trenches are used for different utility companies' utility lines, provide minimum separation between lines per utility companies.
- I. Provide insulating spacer to keep grounding conductor from direct contact with reinforcing steel.

### 3.3 CONCRETE AND CONCRETE WORK

- A. Concrete shall conform to requirement of Section 03300 - CONCRETE minimum 28-day strength shall be 3000 psi.

### 3.4 EXCAVATION AND BACKFILL

- A. All excavation and backfill required because of this work shall be included. Excavation of trenches shall be sequenced to minimize "open time" and inconvenience. Other requirement per DIVISION.
- B. Trenches shall be cut straight and true and shall be shored and braced where required. See DIVISION 1 for specific methods and requirement, or per OSHA requirement.

END OF SECTION

SECTION 16120  
LOW VOLTAGE WIRES AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the requirements for furnishing, installing, and testing all low voltage Aluminum power cables and wires, and the respective accessories as required.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI):
- B. American Society for Testing and Materials (ASTM):
- C. Insulated Cable Engineers Association, Inc. (ICEA):
- D. National Electrical Manufacturers Association (NEMA):
1. NEMA WC5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  2. NEMA WC7: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  3. NEMA WC8: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- E. National Fire Protection Association (NFPA) 70: National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL): 62 Flexible Cord and Fixture Wire.
- G. Rural Electrification Admission Standards (REA): PE 39.
- H. Pacific Gas and Electric Company (PG&E): Engineering Standard No. 33.

1.3 SUBMITTALS

- A. Product data including catalog cuts, manufacturers data and manufacturer's certificate of compliance.

- B. Shop drawings
- C. Certified reports for insulation resistance tests of low voltage power and control wires within one week of performing such tests, as referenced in Article 3.3, Field Quality Control, below.

#### 1.4 QUALIFICATION

- A. The cable manufacturer shall have a minimum of 15 years manufacturing EPR insulated cables.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide markings on wire and cable in accordance with applicable NEMA and NEC requirements. Label each items with UL listing approval.
- B. Ship each material securely wrapped, packaged, and labeled for safe handling during shipment and storage.
- C. Store wire and cable in secure and dry storage facility.

### PART 2 - PRODUCTS

#### 2.1 WIRE AND CABLE

- A. Low Voltage Power and Control Wires:
  - 1. General: All low voltage power shall be rated 600 volts.
  - 2. Single Conductor Wire:
    - a. Conductor Material: ICEA stranded or solid, Aluminum.
    - b. Insulation Rating: 600 volts, flame and moisture resistant thermosetting dielectric.
    - c. Conductor Type:
      - i. Size 10 AWG and larger. Class B stranded.
    - d. Size 14 AWG to 1/0 AWG: NFPA 70, Type XHHW, cross-linked thermosetting polyethylene insulated in accordance with NEMA WC7; or NFPA 70, Type RHH, ethylene-propylene-rubber insulated neoprene jacketed in accordance with NEMA WC 8.
    - e. Size 2/0 AWG and larger: NFPA 70, Type RHH, ethylene propylene-rubber-insulate neoprene jacketed in accordance with NEMA WC8.

- f. Temperature Rating: Temperature ratings of cables shall be not less than 90 degrees C at continuous load.
- g. Color Coding of Conductors:
  - i. 2/20/208 Volts:
    - a) A: Black.
    - b) B: Red.
    - c) C: Blue
    - d) Neutral: White
    - e) Ground: Green.

## 2.2 SOURCE QUALITY CONTROL

- A. All wires and cables shall be factory tested to endure that it has been manufactured in accordance with the applicable standards.

## 2.3 INSULATION

- A. All cables shall meet or exceed all requirements of ICEA S-95-658 NEMA WC70 and UL standards 44 and 854
- B. Cable shall be listed by Underwriters Laboratories as Type RHH

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Low Voltage Power Cables and Wires:
  - 1. Provide wiring systems complete as indicated. Provide ample slack wire for service connections, and extensions.
  - 2. Do not bend cables during installation, either permanently or temporary, to radii less than 12 times the outer diameters, except where conditions make the specified radius impracticable and shorter radii are permitted by NFPA 70 and NEMA WC 7, Appendix N.
  - 3. Wire Pulling: Comply with the requirements listed below:
    - a. Install wire and cable in conduit as indicated. Do not pull wire into conduit until conduits and outlets have been thoroughly cleaned and swabbed. Do not use block and tackle or other mechanical means for pulling conductors smaller than No. 2 AVVG in raceways.

- b. Provide suitable installation equipment to prevent cutting and abrasion of conduits and wire during the pulling of feeders. Use lubricant and installation procedure as recommended by the cable manufacture.
- c. Pulling tension shall not exceed manufacturer's recommendations. For conduits run with three or four bends, and cable size larger than 2 AWG, provide the Engineer with cable pulling calculations prior to making the pull.
- d. Provide masking or other means to prevent obliteration of cable identifications when solid coating or colored tracers are used.
- e. Pull cables installed in a single conduit together.

### 3.2 IDENTIFICATION

#### A. Low Voltage Power Cables and Wires:

- 1. Provide nonmetallic fiberboard or plastic identification tags or pressure-sensitive labels designed for fastening to cables, feeders and power circuits in pullboxes and manholes, and at all terminations of cable wire.
- 2. Stamp or print tags or labels to correspond with markings as indicated, or mark so that feeder or cable may be readily identified. ID tags for lighting and convenience outlets circuits not needed.
- 3. If suspended type identification tags are provided, attach the tags to slip-free plastic cable lacing units or to nylon bundling straps.

### 3.3 FIELD QUALITY CONTROL

#### A. General:

- 1. Insulation resistance and continuity tests shall be made by the Contractor in the presence of the Engineer after cable has been pulled in ducts and conduits, prior to connecting the new cables to existing cable or to equipment.
- 2. Defects in the cable installation revealed by the testers specified shall be corrected by replacement or repairs satisfactory to the Engineer, after which the Contractor shall repeat the tests until he obtains tests results satisfactory to the Engineer.

END OF SECTION

## SECTION 16121

### LOW VOLTAGE SINGLE PHASE ALUMINUM CABLES

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This Section specifies the requirements for furnishing and testing of Triplex 600V, single phase secondary distribution and underground service Aluminum power cables and wires, and the respective accessories as required and shown on the drawings.
- B. The vendor shall furnish cables as specified herein and in the Equipment Schedule.

##### 1.2 REFERENCE STANDARDS

- A. American National Standards institute (ANSI):
- B. American Society for Testing and Materials (ASTM):
  - 1. B-230 Aluminum 1350-H 19 wire for Electrical Purpose
  - 2. 13231 Aluminum 1350 conductors, concentric Lay-standard
  - 3. B609 Aluminum 1350 Round wire, Annealed and intermediate Tempers for Electrical purpose.
  - 4. B-901 Compressed Round standard Aluminum conductors using single input wire.
- C. Insulated Cable Engineers Association, Inc. (ICEA): S-95-658
- D. National Electrical Manufacturers Association (NEMA)
  - 1. NEMA WC5: Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - 2. NEMA WC7: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - 3. NEMA WC8: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- E. National Fire Protection Association (NFPA) 70: National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL): 62 Flexible Cord and Fixture Wire.
- G. Rural Electrification Admission Standards (REA): PE 39.
- H. Pacific Gas and Electric Company (PG&E): Engineering Standard No. 33.



### 1.3 SUBMITTALS

- A. Product data including catalog cuts, manufacturer's data and manufacturer's certificate of compliance. Reference Section 16010.
- B. Shop Drawings.
- C. Certified reports that all wires and cables have been factory tested and manufactured in accordance with the applicable standards.

### 1.4 WARRANTY

- A. The contractor shall furnish a one year (1) warranty for all work covered by this section. Furthermore, all the equipment shall have a 5 year product warranty from the date of final acceptance against material defects and workmanships. Equipment which fails to meet the 5 year warranty period shall be replaced by the manufacture, including labor, materials at no cost to the city.

### 1.5 QUALIFICATION

- A. The cable manufacturer shall have a minimum of 15 years manufacturing secondary underground insulated cables.

### 1.6 DELIVERY AND HANDLING

- A. Provide markings on wire and cable in accordance with applicable NEMA and NEC requirements. Label each items with UL listin<sup>9</sup> approval.
- B. Store wire and cable in secure and dry storage facility until ready for delivery.
- C. Ship each material securely wrapped, packaged, and labeled for safe handling during shipment.

## PART 2 - PRODUCTS

### 2.1 WIRE AND CABLE

- A. General: All conductors shall be stranded, compressed 1350-H19, H16, or H29 aluminum, insulated with vulcanized interlinked polyethylene cross-linked. Neutrals shall be triple yellow extruded strip. The cable shall be manufactured by Southwire or approved equal.
- B. Conductors shall be durably surface printed for identification
  - 1. Conductor Material: ICEA stranded or solid, Aluminum.
  - 2. Insulation Rating: 600 volts, Cross-linked Polyethylene (XLP).

### 2.2 SOURCE QUALITY CONTROL

HILLPOINT REGIONAL PARK & COLEMAN BLUFF PATH  
HUNTERS POINT SHIPYARD PARCEL A'  
HPS DEVELOPMENT COMPANY  
ISSUED FOR RE-BID  
GHD

LOW VOLTAGE SINGLE  
PHASE ALUMINUM CABLES  
16121-2  
11/10/2014

- A. All wires and cables shall be factory tested to endure that it has been manufactured in accordance with the applicable standards.

## 2.3 INSULATION

- A. All cables shall have Cross-linked Polyethylene (XLP)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Low Voltage Power Cables and Wires:

1. Provide wiring systems complete as indicated. Provide ample slack wire for service connections, and extensions.
2. Do not bend cables during installation, either permanently or temporary, to radii less than 12 times the outer diameters, except where conditions make the specified radius impracticable and shorter radii are permitted by NFPA 70 and NEMA WC 7, Appendix N.
3. Wire Pulling: Comply with the requirements listed below:
  - a. Install wire and cable in conduit as indicated. Do not pull wire into conduit until conduits and outlets have been thoroughly cleaned and swabbed. Do not use block and tackle or other mechanical means for pulling conductors smaller than No. 2 AWG in raceways.
  - b. Provide suitable installation equipment to prevent cutting and abrasion of conduits and wire during the pulling of feeders. Use lubricant and installation procedure as recommended by the cable manufacture.
  - c. Pulling tension shall not exceed manufacturer's recommendations. For conduits run with three or four bends, and cable size larger than 2 AWG, provide the Engineer with cable pulling calculations prior to making the pull.
  - d. Provide masking or other means to prevent obliteration of cable identifications when solid coating or colored tracers are used.
  - e. Pull cables installed in a single conduit together.

### 3.2 IDENTIFICATION

#### A. Low Voltage Power Cables and Wires:

1. Provide non metallic fiberboard or plastic identification lags or

pressure-sensitive labels designed for fastening to cables, feeders and power circuits in pullboxes and manholes, and at all terminations of cable wire.

2. Stamp or print tags or labels to correspond with markings as indicated, or mark so that feeder or cable may be readily identified. ID tags for lighting and convenience outlets circuits not needed.
3. If suspended type identification tags are provided, attach the tags to slip-free plastic cable lacing units or to nylon bundling straps.

### 3.3 FIELD QUALITY CONTROL

#### A. General:

1. Insulation resistance and continuity tests shall be made by the Contractor in the presence of the Engineer after cable has been pulled. in ducts and conduits, prior to connecting the new cables to existing cable or to equipment.
2. Defects in the cable installation revealed by the testers specified shall be corrected by replacement or repairs satisfactory to the Engineer, after which the Contractor shall repeat the tests until he obtains tests results satisfactory to the Engineer.

END OF SECTION

SECTION 16132  
PULLBOXES AND MANHOLES

PART 1 - GENERAL

1.1 CONDITION & REQUIREMENTS

- A. Refer to General Conditions, Supplementary General Conditions, and Division 1 General Requirements.

1.2 DESCRIPTION OF WORK

- A. Pull boxes and manholes shall be provided as shown on the and as specified, herein.
- B. Related work included in other sections: All other sections of Division 16.

1.3 SUBMITTALS

- A. Shop Drawings and Product Data: The following list includes the required shop drawings that shall be submitted.
  - 1. Thickness of all metals.
  - 2. Reinforcing iron dimensions and placement.
  - 3. Concrete dimensions.
  - 4. Dimensions or pull irons and gauges.
  - 5. Interior dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Precast Concrete Pullboxes and Manholes: Boxes shall be Christy, Brooks, Utility Vault or equal.
  - 1. Manholes shall comply with each utility company's requirement and shall be equipped with the following as the minimum requirement. Contractor shall coordinate with each Utility company prior to submit purchase order :
    - a. Ground rod measuring 5/8 inch x 10-feet.
    - b. Two (2) 48-inch cable rack irons on each side of wall.
    - c. Pull irons shall be 1/2-inch diameter galvanized steel.

d. 36" Joint 10" STD V.C. Drain Tile.

B. See landscape drawings "L" series for additional requirements for pullbox and manholes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install precast manholes and pullboxes of sizes required on the plans. In addition, the Contractor shall:
1. Place duct and conduit entries six inches above floor of manholes. Provide end bells in all duct entrances. Terminate each metal conduit with insulated bushing having grounding terminal.
  2. Place pulling irons in manholes on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
  3. Damp proof exterior walls and tops of below-grade manholes and pullboxes with two (2) coats of damp proofing material.
  4. Install a floor drain into a sump containing two cubic yards of crushed rock; minimum size 48 inches deep and 36 inches diameter. Provide 36-inch length of 8-inch diameter tile pipe extending down into the sump. Provide a grille over the top opening of pipe.
  5. Provide a 5/8" x 10' long ground rod in every manhole and concrete pullbox. Locate each ground rod near a wall with 6-inch projection above floor for ground clamps. If rock bottom is encountered, bury ground rod in horizontal trench with projection into manhole. Obtain prior approval from Owner's Agent. Permanently ground all metal equipment cases, cable racks, etc., in manholes and pullboxes.
  6. Provide a 6-inch deep sand base under each pullbox and a 18-inch gravel sump under each manhole.
  7. Identify all power and signal cables by tagging in all manholes and pullboxes. Tie tags securely to cables with nylon cord or insulated type TW wire. Tie so turns of wires do not form a closed electrical circuit.

END OF SECTION

## SECTION 16450

### GROUNDING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Furnish and install a grounding system for building service entrance, raceway systems and metal parts of all equipment with-an electrical connection and an isolated grounding system per requirements of the NFPA 70.
- B. The materials and equipment herein specified shall be new, of domestic manufacturer, and furnished in accordance with the applicable specifications of the National Electric Manufacturers Association, Institute of Electrical and Electronics Engineers, National Fire Protection Association, and/or the National Electrical Code.
- C. Related Sections:
  - 1. Section 16050 - Electrical Materials and Methods
  - 2. Section 16010 – Electrical General Provisions

##### 1.2 REFERENCES

- A. ASTM B8 Concentric-Lay Stranded Copper Conductors, Hard, Medium Hard, or Soft
- B. IEEE 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- C. NFPA 70 National Electric Code (NEC)
- D. UL 467 Grounding and Bonding Equipment

##### 1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Furnish manufacturer's data on the following information for review and approval.
  - 1. Ground Rods
  - 2. Bare Copper Ground Conductors
  - 3. Insulated Copper Ground Conductors
  - 4. Grounding Bushings
  - 5. Ground Bus for Isolated Ground System
  - 6. Exothermic Process Connection Technique
  - 7. Ground Clamps

## PART 2 - PRODUCTS

### 2.1 GROUND RODS

- A. Furnish solid, copper-clad steel ground rods in accordance with UL 467 with adequate diameter to permit driving it full length of the rod in the earth but not less than 3/4-inch diameter and ten feet in length. Ground rods Shall have\* copper coating of minimum .012 inch thickness.
- B. Acceptable Manufacturer - Caldweld XIT Grounding Systems or an approved equal.

### 2.2 GROUNDING CONDUCTORS

- A. Grounding electrode conductors for building ground system shall be bare, soft-drawn, stranded copper conductor in accordance with ASTM B8 for grounding of metallic structures of the sizes shown on the drawings.
- B. Equipment grounding conductors shall be green PVC insulated stranded copper conductors manufactured in accordance with ASTM B8 And sized in accordance with NFPA 70 requirements as shown on the drawings.
- C. Ground Conductors for isolated grounding. System shall be color-coded green with yellow stripes.

### 2.3 CONNECTORS

- A. Mechanical connectors shall be threaded stud, nut and clamp type of bronze material designed for the conductor size, for connecting grounding conductors to equipment ground bus.
- B. Exothermic-weld connections shall be made by using reusable or one-time molds with crucibles and powder to produce a molecular weld between conductors, between conductor and lug, or between conductor and ground rod or steel structure. Provide for all underground connections of grounding conductors and for grounding conductors, to ground rods except as indicated on the drawings.
- C. Compression type connectors for copper conductors may be used for above-ground connections for smaller grounding conductors in the range of #12 AWG to #8 AWG. Provide ring-tongue type, installed with proper compression tool.
- D. Provide grounding bushings with positive bonding to enclosure with feed-through capabilities of grounding conductors and nylon grommet for conductor protection.
- E. Acceptable Manufacturers - Cadweld Killack, O.Z. Gedney, Thomas & Betts, or an approved equal.

### 2.4 CONDUIT SLEEVES

- A. Provide sleeves of schedule 80 PVC duct or PVC coated RGS conduit for routing

- B. Where grounding cable is installed in metallic conduit, it shall be bonded to the conduit at each end in accordance with Article 250 of the National Electrical Code.

## PART 3 - EXECUTION

### 3.1 GROUNDING

- A. Grounding shall be in accordance with the National Electrical Code. Water piping shall not be used for the grounding electrode but shall be bonded to the grounding electrode system at one point only. Grounds and grounding systems shall have a resistance to solid earth ground not exceeding the following values:

| System  | Ohms |
|---|------|
| For grounding primary non-current carrying metal parts associated with electrical equipment and for grounds not covered above | 5    |
| For grounding secondary neutral non-current carrying metal parts associated with electrical equipment                         | 25   |
| For grounding isolated grounding system   | 10   |

### 3.2 SYSTEM GROUNDS

- A. Properly bond system neutral to system in the service entrance equipment. All other neutral busses, bars, etc., shall be isolated from ground. Establish the building ground system as the ground bus within the distribution switchboard by providing the properly sized grounding conductor, bonded to the grounding bus and extended to the grounding electrodes.
- B. Properly bond system-neutral of separately derived systems to building grounding electrode system via the ground bus in the associated distribution switchboard with bonding conductor sized in accordance with Table 250-94 of the NEC. Refer to drawings for additional grounding requirements.
- C. Properly bond the isolated ground system to building grounding electrode system in one (1) location at approximate orientation shown on the drawings.
- D. Building metallic piping systems- with existing grounding electrode conductor connections shall not be used for grounding but shall be bonded to site grounding system.



- E. Where nonmetallic conduit is used, provide green insulated grounding conductor.
- F. Connections to building steel and new metallic piping system shall be made with exothermic type connections.
- G. Service entrance grounding shall consist of bonding ground bus of distribution switchboard to building grounding electrode system. An exothermic type connection shall be used to connect grounding electrode conductor to the grounding electrode.

### 3.3 EQUIPMENT GROUNDING

- A. Make firm connection between ground system and raceway system by means of suitable connectors. Where equipment is connected with flexible conduit indoors, or where ground wire inside the conduit is impractical, provide bare copper ground wire around the outside of flexible conduit, connecting the metal parts of equipment to the rigid conduit system. Use mechanical connectors for connecting copper ground wire to protruding screw of conduit connector instead of placing wire under a screw-head.
- B. Where flexible conduit is used to serve lighting fixtures, ensure grounding through the flexible conduit from the fixture housing to the outlet box; however, if tightness of the conduit connectors cannot be ensured, provide a green grounding conductor of the same size as power conductors in the flexible conduit, bonded under hex head green colored screw on the fixture end, and with a box grounding clip on the outlet box end.
- C. A green insulated copper ground wire, sized per table 250-95 of NEC shall be provided with each feeder or branch circuit operating over 156 volts to ground. This ground wire shall be used for the grounding of all equipment associated with feeder or branch circuit.
- D. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 8-32 or larger.
- E. Each panelboard, switchgear, pullbox or any other enclosure in which several ground wires are terminated, shall be equipped with a ground bus, and where applicable an isolated ground bus, secured to the interior of the enclosure. The bus shall be equal to the phase bus size and shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.
- F. Ground cabinets, junction boxes, outlet motors, controllers, raceways, fitting switchboard, other equipment and metal enclosures. Bonding of equipment and to the continuously grounded, metallic system is required in addition to any specific grounding shown by means of a bushing with bonding conductor attached to associated equipment.
- G. Provide bonding jumpers and ground wire throughout to insure electrical continuity of the grounding system.

- H. Provide grounding bushings for all conduits terminating in equipment enclosures and bond the bushing to the ground bus or equipment grounding lug.

### 3.4 GROUND RODS

- A. Drive ground rods for connection to building grounding electrode system their full length in a depression at least six (6) inches below finished grade.

### 3.5 PIPING SYSTEM GROUNDING

- A. Building piping systems shall not be used for grounding, but shall be bonded to main service ground.
- B. Reinforcing steel within building floor slabs shall be bonded to main service ground to form complete grounding electrode system.
- C. Do not shunt around any dielectric unions in piping systems.
- D. Connections to metallic piping systems shall be made by exothermic type process, using a capped "T" for ground connection.

### 3.6 SERVICE ENTRANCE GROUNDING

- A. Grounding electrodes for service entrance shall consist of an assembly of driven ground rods placed at locations shown on the drawings, interconnected with a 1/0 AWG grounding electrode conductor. The recommended measured ground resistance of the three (3) ground rods combined shall be less than 5 ohms (in accordance with spec section 16060, 3.01E), measured at least forty-eight (48) hours after rainfall. The top of the rod shall be six inches (6") below the surface. Rods shall be driven in undisturbed earth.
- B. Grounding Electrode Conductor shall be sized as shown on drawings, completely encircling the ground rods and the building forming a ground loop. The ground bus within the distribution switchboard shall be bonded to the building ground loop.
- C. Make all grounding connections which are to be buried or otherwise normally inaccessible using exothermic connection. Connections that have puffed up or show convex surfaces (indicating improper cleaning of the surface) are not acceptable. No mechanical connector is required at the exothermic weld.

### 3.7 TESTING

- A. Perform ground resistance test on all driven ground rods in accordance with IEEE 142.
- B. Drive reference ground rods; one located 50 feet from the ground under test, and the other located an additional 50 feet in the same direction away from the ground rod under test. Disconnect ground rod to be tested from permanent

ground-system, and connect megger in-line between ground rod being tested and reference ground rods.

- C. Use Megger Ground Tester with maximum scale range of 0 to 20 ohms. The resistance to ground for equipment and system grounds shall not exceed ten (10) ohms unless otherwise indicated in this section.
- D. Testing shall be witnessed by the Owner or designated representative with a letter giving the test results included in the final contract documents.

END OF SECTION

## SECTION 16526

### LIGHTING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included in this section consists of furnishing and installing lighting system with manufacturer's instructions at the locations indicated, complete with poles, concrete foundations with anchor bolts, luminaries with lamps, and accessories ready for operation as indicated. All lighting systems shall be complete and operable. In the event that the other sections of the specifications are in conflict, this section shall have precedence in regards to street lights.
- B. Related work specified in other sections:
  - 1. Section 02225 –Excavation, Backfilling and Compaction for Utilities
  - 2. Section 02502 – Street Work not in Contract Damaged by Contractor
  - 3. Section 16010: Electrical General Provisions.
  - 4. Section 16050: Electrical Materials and Methods.

##### 1.2 QUALITY ASSURANCE

- A. Refer to Section 16010: Electrical General Provisions.

##### 1.3 WARRANTY

- A. The contractor shall furnish a one year (1) warranty for all work covered by this section, furthermore the luminaire shall have a 5 year product warranty from the date of final acceptance against material defects and workmanships. Luminaires which include lens/refractors that fail to meet the 5 year warranty period shall be replaced by the manufacture, including labor, materials at no cost to the city.

##### 1.4 SUBMITTALS and AS BUILT DRAWINGS

- A. Refer to Section 16010 " Electrical General Provisions".
- B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data. Manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under

Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

- D. Maintenance Data: For each luminaire.
- E. Luminaires photometric data in IES foil format.
- F. Closeout submittals: Furnish three of each type and wattage lamp installed.
- G. Contractor shall submit as-built drawings as stated in Section 01720, prior to acceptance of work.

## 1.5 REFERENCE STANDARDS

- A. American National Standards Institute

ANSI/NFPA 70 - National Electrical Code.

ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type).

- B. The City and County of San Francisco Electrical Code.

## 1.6 COORDINATION

Furnish bolt templates and pole mounting accessories to installer of pole foundations.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES

- A. Luminaires 70 watts through 150 watts shall be BEGA or Philips as shown on lighting fixture schedule on the contract plans.
- B. Each luminaire shall be 120/240 VAC high power factor magnetic regulator ballast, reflector, glass refractor, and photo electric control receptacle.
- C. Cut off lenses and devices shall require specific approval by the Bureau of Light, Heat, & Power by variance.
- D. The lamps for the luminaires shall be clear High Pressure Sodium vapor with mogul bases manufactured by General Electric, Philips, Sylvania, or equal and shall be installed in accordance with the manufacturer's recommendations.
- E. Furnish, install and connect lighting fixtures as indicated on the lighting plans.

The fixtures shall be complete with all glassware, canopies, sockets, lenses, and wiring accessories for a complete installation. All fixtures shall be supplied with lamps of the type and wattage indicated in accordance with the manufacturer's recommendations.

## 2.2 PHOTOCELLS

- A. For street lights equipped with photoelectric control, the photocell shall be Type IV consisting of a photoelectric unit which plugs into an EEL-NEMA twist lock receptacle integral with the luminaire. The photoelectric controls shall be operable within a minimum voltage range between 105 and 280 VAC.
- B. All photoelectric controls shall be oriented to the north.
- C. Photoelectric controls for luminaires shall be Dark To Light, model No. D124

## 2.3 L2 LIGHT POLES – 14' TALL POLE

- A. Manufacturer: Phillips Lumec, represented by Associated Lighting Representatives, Inc, (510) 638-3800 x 112, [www.alrinc.com](http://www.alrinc.com)
- B. Model: SPR5 (Steel)
- C. Mounting Model: RSAR
- D. Finish: Powdercoat black

## 2.4 L3 LIGHT POLES – 25' TALL POLE

- A. Manufacturer: Union Metal Corporation, represented by Associated Lighting Representatives, Inc, (510) 638-3800 x 112, [www.alrinc.com](http://www.alrinc.com)
- B. Model/Design Number: 50055-B94-Y2
- C. Materials: Steel
- D. Finish: Hot dipped galvanized and powdercoated
- E. Powdercoat color: TGIC Light Gray (AAL color code: LGY)
- F. Mounting: See Drawings

## 2.5 L3 LIGHT POLES – 50' TALL POLE

- A. Manufacturer: Union Metal Corporation, represented by Associated Lighting Representatives, Inc, (510) 638-3800 x 112, [www.alrinc.com](http://www.alrinc.com)
- B. Model/Design Number: 50055-B94-Y1

- C. Materials: Steel
- D. Finish: Hot dipped galvanized and powdercoated
- E. Powdercoat color: TGIC Light Gray (AAL color code: LGY)
- F. Mounting: See Drawings

## 2.6 PULLBOXES

- A. All pull boxes shall be per SFDPW Standard Plan 49,093 Ch. 1 and shall be installed within five feet of the base of all street light poles.
- B. Pull boxes shall not be more than 250 feet apart on long runs.
- C. Pull boxes shall not be place where they will be subject to vehicular traffic.
- D. Pull box covers shall be inscribed with first line, "STREET LIGHTING", and the second line, "120/240 VOLT". Letters shall be 1-inch and made with 1/4-inch wide strokes. Letters inscribed in concrete lid cover shall be with 1/8-inch (minimum) deep imprints. Legends in steel covers shall be with weld bead letters.
- E. All pull boxes shall be installed with crushed rock pad as shown on SFDPW Standard Plan 49,093 Ch. 1. Installation of pullboxes in dirt or grassy areas shall be supported by 3' X 3' X 6" concrete slab, all around.

## 2.7 CONDUIT

- A. Conduit shall be 1 1/2-inch hot-dip galvanized rigid steel as indicated in Section 601 of Standard Specifications, Bureau of Engineering, Department of Public Works, City and County of San Francisco dated November, 2000.
- B. All steel conduit and other metal parts, including bonding bushing, shall be hot-dip galvanized and shall be N.E.C. approved parts and shall be continuously bonded and grounded per N.E.C. requirements.
- C. All bends and /or offsets shall be made with factory sections using approved couplers per N.E.C. requirements.
- D. All empty conduits shall have a one-quarter inch polypropylene pull rope provided inside and sealed with a duct seal, approved by BLHP, on both ends of the -conduit.
  - 1. The ends of all conduits installed shall be sealed with a duct seal approved by BLHP. Conduits stubbed for future extension shall be capped.

## 2.8 WIRING

- A. Unless authorized otherwise, all wiring for street lights No. 10 AWG shall be solid copper and No. 8 AWG or larger shall be stranded copper, insulated for 600 volt with color codes per SPDPWSF #49,092, with Type THW insulation. All wiring shall be of the following sizes:
  - 1. All field wiring: #8 minimum (N.E.C.)
  - 2. Pull box to street light: #10 minimum (N.E.C.)
  - 3. All wire in pole: #10 minimum (N.E.C.)
- B. Except as noted, all wiring methods and equipment construction shall conform to the National Electric Code (N.E.C.) and applicable sections of the Standard Specifications, Bureau of Engineering, Department of Public Works, City and County of San Francisco, dated November, 2000.
- C. All splices shall be made in accordance with SFDPW Standard Plan 43,665, Ch.2.

## 2.9 BONDING AND GROUNDING

- A. The grounding and bonding shall meet the requirements of ASTM 3, NEC and UL 467.
- B. Ground rod shall be medium carbon steel core, copper clad by molten weld cast process, UL listed, 5/8-inch in diameter and minimum of 10-foot long, and shall be installed in accordance with SPDPW 49,092.
- C. Ground wire clamp shall be 5/8 " copper alloy, HEX head screw, with 3/8-16UNC, manufactured by O-Z Gedney, Dossert, Burndy or approved equal . Ground rod clamp setscrew should be tightened against the ground rod, and not against the ground wire. Ground wire should be installed in the clamp on the side opposite the set screw
- D. Steel standards with hand holes and other enclosures providing access to the conduit ends shall be bonded to the conduit with grounding conductor terminated in a screw-type copper box-shaped terminal. The terminal shall be secured to the interior surface of the equipment near the foundation with stainless steel screw equipped with a stainless steel internal tooth-lock washer or to the neutral bus provided in such enclosures unless otherwise noted or directed. The head of the screw shall be installed on the interior surface of the equipment and the screw shall be terminated with exterior surface of the equipment.



- E. Provide exothermic welding such as Caldwell or approved equivalent only to buried and embedded ground connections. Prior to backfilling, clean and coat welded connections with a bitumastic epoxy coating. Make welds in accordance in accordance with the manufacturer's requirements. Compression-type mechanical connectors are not acceptable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install lighting fixtures at locations indicated and in accordance with the manufacturer's instructions, complete with lamps, hangers, brackets, fittings, and accessories, ready for operation as indicated.
- B. Each street light shall have a fuse holder and fuse in each required pullbox adjacent to the pole and shall conform to SPDPWSF #49,092.
- C. The wiring for the street light shall conform to the requirements of SPDPWSF #49,092.
- D. Align, mount, and level lighting fixtures uniformly.
- E. All splices for street lighting shall be made in accordance with SPDPWSF #43,665 Ch 2.
- F. The concrete footing requirements shall conform to the requirements of SFDPW Standard Plan A-27,029.2 Ch. 4 for steel street light standards and SFDPW Standard Plan A-32,051 Ch. 4 for concrete street light standards. The class of concrete for foundation shall be Class 7- 4000-1% with 4-inches maximum slump.
- G. The use of insulating boot on each fuse holder is not allowed for service connection. Installed connectors shall be wrapped with a minimum of four half-lapped layers of rubber or rubber mastic tape. Overlap with at least two half-lapped layers of Scotch 33+ vinyl or approved premium tape. After taping splices, apply Scotchkote electrical coating evenly over splices or as recommend by the manufacturer.

### 3.3. FIELD -QUALITY CONTROL

- A. Inspect luminaires, lamps, and associated hardware before and after installation to ensure that they are of the quality and type specified herein and indicated on the Drawings, and are free of defects and damage.
- B. Install new lamps not earlier than 48 hours before the date of final inspection and replace lamps that fail within 90 days after final acceptance at no extra cost to the City.
- C. Test lighting fixtures for continuity to the grounding system.

### 3.4 ADJUSTING

- A. Aim and adjust luminaires with the street side of the luminaire aimed towards the

street perpendicular to the curb or as indicated by the direction of the directional arrow as shown in the drawings.

### 3.5 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean finishes and touch up damage.
- D. Clean photometric control surfaces as recommended by manufacturer.

### 3.6 PROTECTION OF FINISHED WORK

- A. Relamp luminaires which have failed lamps at Substantial completion.

### 3.7 COORDINATION WITH SFPUC POWER ENTERPRISE.

- A. The contractor shall submit to the SFPUC Power Enterprise engineering group a service application in writing to schedule for the electrical service connection of the streetlights from their designated service pull box to the streetlighting pullbox. Furthermore, the contractor shall coordinate their work with SFPUC Power Enterprise engineering group in order to minimize delays in the connection of services to streetlights.

END OF SECTION